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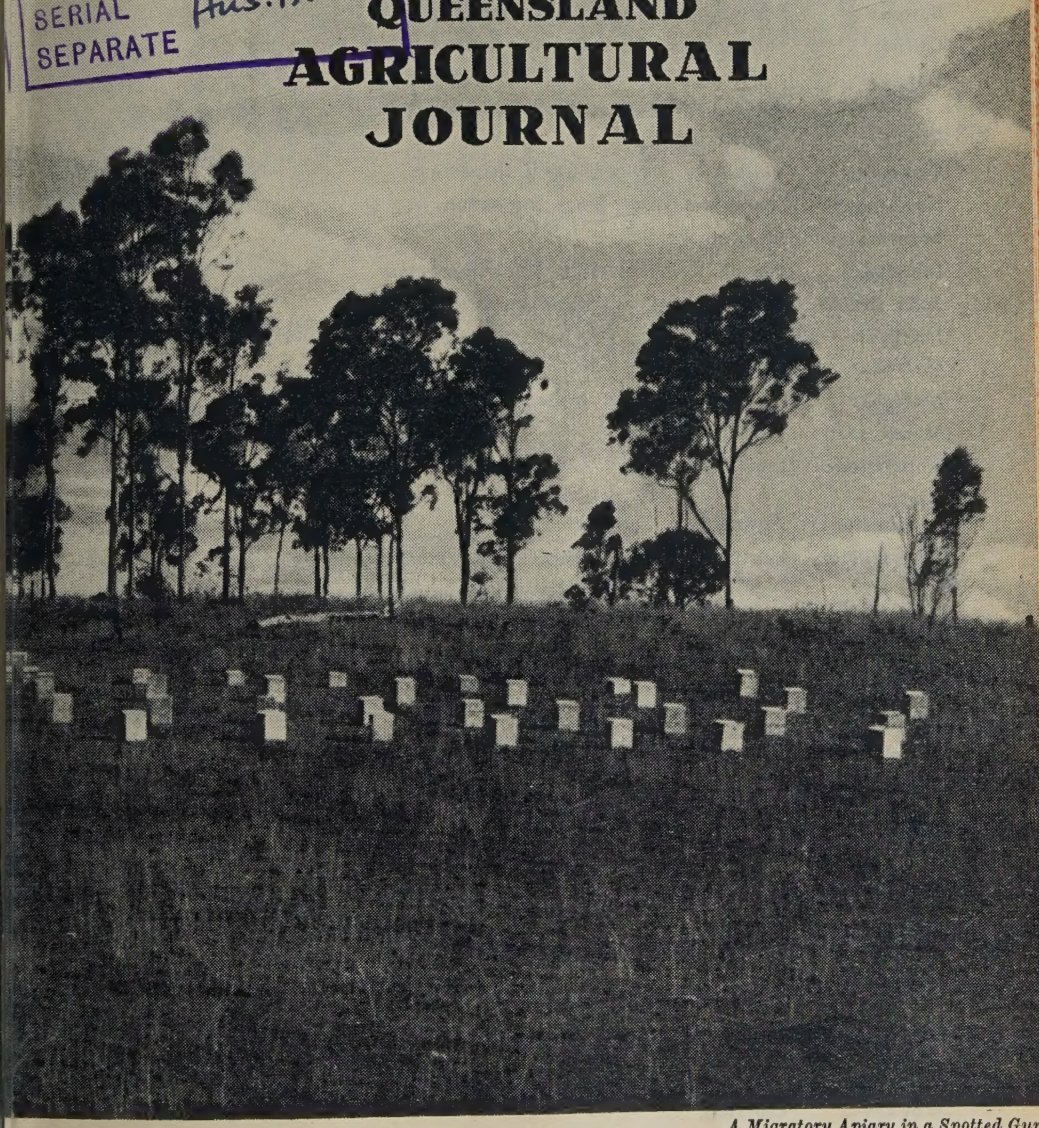

A Migratory Apiary in a Spotted Gum Location at Jimboomba.

LEADING FEATURES

Sorghum Midge
Guinea Grass
Timber Rake
Supplementary Feeding of Sheep
Seasonal Calving for Dairy Cows
Cowpox
Infectious Laryngo-tracheitis
Dairy Calf Feeding

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(A list of extension services in southern Queensland will appear in our next issue.)

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Tuberculosis-Free Cattle Herds.

TESTED HERDS (As at 30th April, 1955).

The Tuberculosis-free Herd Scheme (which is distinct from the tuberculosis eradication scheme operating in commercial dairy herds) was initiated by the Department of Agriculture and Stock for the purpose of assisting owners of cattle studs to maintain their herds free from tuberculosis and so create a reservoir of tuberculosis-free cattle from which intending purchasers can draw their requirements. The studs listed here have fulfilled the conditions to the date shown above.

Breed.	Owner's Name and Address.
Aberdeen Angus ..	The Scottish Australian Company Ltd., Texas Station, Texas
A.I.S.	M. E. & E. Scott, "Wattlebrae" A.I.S. Stud, Kingaroy
	F. B. Sullivan, "Fermanagh," Pittsworth
	D. Sullivan, "Bantry" Stud, Rossvale, *via* Pittsworth
	W. Henschell, "Yarranvale," Yarranlea
	Con. O'Sullivan, "Navillus" Stud, Greenmount
	H. V. Littleton, "Wongalea" Stud, Hillview, Crow's Nest
	J. Phillips and Sons, "Sunny View," Benair, *via* Kingaroy
	Sullivan Bros., "Valera" Stud, Pittsworth
	Reushle Bros., "Reubydale" Stud, Ravensbourne
	H. F. Marquardt, "Chelmer" Stud, Wondai
	A. C. and C. R. Marquardt, "Cedar Valley," Wondai
	A. H. Sokoll, "Sunny Crest" Stud, Wondai
	W. and A. G. Scott, "Welena" A.I.S. Stud, Blackbutt
	G. Sperling, "Kooravale" Stud, Kooralgin, *via* Cooyar
	C. J. Schloss, "Shady Glen," Rocky Creek, Yarraman
	W. H. Thompson, "Alfa Vale," Nanango
	S. R. Moore, Sunnyside, West Wooroolin
	H.M. State Farm, Numinbah
	D. G. Neale, "Groveley," Greenmount
	Edwards Bros., "Spring Valley" A.I.S. Stud, Kingaroy
	A. W. Wieland, "Milhaven" A.I.S. Stud, Milford, *via* Boonah
	W. D. Davis, "Wamba" Stud, Chinchilla
	Queensland Agricultural High School and College, Lawes
	C. K. Roche, Freestone, Warwick
	Mrs K. Henry, Greenmount
	D. B. Green, Deloraine Stud, Durong, Proston
	E. Evans, Wootha, Maleny
	T. L. and L. M. J. Cox, "Seafield Farm," Wallumbilla
	J. Crookey, "Arolla A.I.S. Stud" Fairview, Allora
	M. F. Power, "Barfield," Kapaldo
Ayrshire	L. Holmes, "Benbecula," Yarranlea
	J. N. Scott, "Auchen Eden," Camp Mountain
	"St. Christopher's" and "Iona" Studs, Brookfield road, Brisbane
	E. Mathie and Son, "Ainslie" Ayrshire Stud, Maleny
	C. E. R. Dudgeon, "Marionville" Ayrshire Stud, Landsborough
	G. F. H. Zerner, "Pineville," Pie Creek, Box 5, P.O., Gympie
	T. F. Dunn, Alanbank, Gleneagle
Friesian	C. H. Naumann, "Yarrabine" Stud, Yarraman
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	A. B. Fletcher, Cossart Vale, Boonah
	W. H. Doss, Degilbo, *via* Biggenden
	A. C. Swendson, Coolabunia, Box 26, Kingaroy
	C. Scott, "Coralgrae," Din Din road, Nanango
	R. J. Wissemann, "Robnea," Headington Hill, Clifton
Jersey	Queensland Agricultural High School and College, Lawes
	J. S. McCarthy, "Glen Erin" Jersey Stud, Greenmount
	J. F. Lau, "Rosallen" Jersey Stud, Goombungee
	G. Harley, Hopewell, M.S. 189, Kingaroy
	Toowoomba Mental Hospital, Willowburn
	Farm Home for Boys, Westbrook
	F. J. Cox and Sons, "Rosel" Stud, Crawford, Kingaroy Line
	R. J. Browne, Hill 60, Yangan
	P. J. L. Bygrave, "The Craigan Farm," Aspley
	R. J. Crawford, "Inverlaw" Jersey Stud, Inverlaw, Kingaroy
	P. H. F. Gregory, "Carlton," Rosevale, *via* Rosewood
	E. A. Matthews, "Yarradale," Yarraman
	A. L. Semgreen, "Tecoma," Coolabunia
	L. E. Meier, "Ardath" Stud, Boonah
	A. M. and L. J. Noone, "Winbirra" Stud, Mt. Esk Pocket, Esk
	W. S. Conochie and Sons, "Brookland" Stud, Sherwood road, Sherwood
	Estate of J. A. Scott, "Kiaora," Manumbar road, Nanango
	F. W. Verrall, "Coleburn," Walloon
	C. Beckingham, Trouts road, Everton Park
	W. E. O. Meier and Son, "Kingsford" Stud, Alberton, *via* Yatala
	G. H. Ralph, "Ryecombe," Ravensbourne
	Mrs. I. L. M. Borchert, "Willowbank" Jersey Stud, Kingaroy
	W. and C. E. Tudor, "Boree" Jersey Stud, M.S. 498, Gayndah
	Weldon Bros., "Gleneden" Jersey Stud, Upper Yarraman
	D. R. Hutton, "Bellgarth," Cunningham, *via* Warwick
	J. W. Carpenter, Flagstone Creek, Helidon
	H. G. Johnson, "Windsor" Jersey Stud, Beaudesert
	W. S. Kirby, Tinana, Maryborough
	S. A. Cramb, "Trecarne Stud," Lockyer
	G. & V. Beattie, "Beauvern," Antigua, Maryborough
Polled Hereford ..	W. Maller, "Boreview," Pickanjinnie
	J. H. Anderson, "Inverary," Yandilla
	D. R. and M. E. Hutton, "Bellgarth," Cunningham, *via* Warwick
	E. W. G. McCamley, Eulogie Park, Dululu
	Wilson and McDouall, Calliope Station, Calliope

Know the Water Requirements of Your Crops.*

By W. G. WELLS, Director of Regional Experiment Stations.

The water requirements of crop and pasture plants have been studied by agricultural scientists in many countries since Drs. Shantz and Briggs conducted their classical investigations in this subject some forty years ago.

Working in the arid western section of the United States these scientists developed methods by which even the daily use of water by plants could be determined. They expressed the water requirement of a plant as the ratio of the weight of water absorbed by a plant during its growth to the weight of dry matter produced, exclusive of its roots.

After many tests of a large range of crops and varieties, their findings indicated that there were marked differences in the water requirements of the main agricultural crops and also between varieties in each crop.

They found that, amongst the more drought resistant crops, a grain sorghum plant uses an average of about 300 lb. of water to produce 1 lb. of dry matter (that is, if the mature plant was cut and dried of all water and the final dry weight was say 5 lb., the plant would have used 1,500 lb. of water during its growth). In contrast, lucerne was one of the most luxuriant users of water—its requirement being around 900 lb., or 90 gallons, of water to produce 1 lb. of dry matter.

They found that, between these two extremes, the water requirements of the main crops could be classed in the following increasing order—sudan grass, maize, wheat, cowpea, oats, cotton, clovers, grasses and linseed—the last three closely approaching lucerne in their requirements.

The study of the water required by the major grain crops to produce 1 lb. of grain was equally informative. Grain sorghum required 1,000 lb. of water to produce 1 lb. of grain, maize 1,200 to 1,400 lb., wheat 1,050 to 1,350 lb. according to variety, and linseed around 2,800 lb. of water for 1 lb. of seed.

These findings greatly stimulated agricultural research in many countries to ascertain if the results apply to all conditions. In Queensland, at the Regional Experiment Stations, field studies have been conducted to find out the amount of water used by plants and the stages of plant growth when water supply is most important.

The results obtained have shown that, under Queensland conditions, the water usage timetable of the plants is of more importance than the total amount of water used. In other words, if ample water is not available to a plant at a certain critical stage in its development, the resultant damage cannot be remedied by a more than ample supply of water at a later

*An A.B.C. "Country Hour" talk.

stage in the growth of the plant These findings apply particularly to grain sorghum, maize, cotton and wheat. We expect to find that they apply also to other crops.

By way of illustration, the results at the Biloela Regional Experiment Station may be mentioned, to show how the plants use water in that fairly dry area where the annual rainfall averages 28 inches.

Wheat crops planted in late May or June on well fallowed land develop satisfactorily under limited rainfall until the flowering stage is reached, when the plants have utilized most of the available water in the top 30 inches of soil. Provided the next two feet of soil is wet to field capacity, a crop of at least 20 bushels can be anticipated. If a steady 2-inch rain occurs at the flowering stage to replace the moisture used out of the top foot of soil, the extra development of heads and the number of grains per head may increase yields by 8-12 bushels per acre.

Similarly, it has been found that the yields of grain sorghum are very closely correlated with the amount of water available to the plants up to the completion of the flowering stage.

Unfortunately, the rainfall of much of Queensland in which general farming is practised is characterised by both irregular occurrence of the rainfall and high intensity storms. Frequently, rains do not occur regularly enough to replenish the water used by crops, even that in the top foot of soil. Consequently, emphasis is placed on the necessity to practise methods of farming that will allow of the fullest economical storage of subsoil moisture before each crop is planted.

Investigations with this objective are therefore conducted at each of the Regional Experiment Stations. Broadly speaking, it has been found that fallows of appropriate duration are required to obtain this storage of water before planting each crop. In addition, on soils of poor structure, rotations embracing short-term pastures (leys) are needed to maintain the permeability of the top soils, thereby allowing a greater absorption of storm rains. Animals which are required to graze the pastures enrich the soil, particularly in regard to nitrate-nitrogen. This in turn is beneficial, as a correct nitrogen balance increases the efficient utilization of moisture by the crops.

It can be seen, however, that the wide range of water requirements of the major crops grown in the main agricultural districts of this State, and the irregular distribution of rainfall, dictate that the farmer must consider the water requirements of each crop when planning his farming operations.

In addition, he must consider the depth of wet soil obtainable in each field at crop planting time. Obviously, a summer crop with a high water requirement cannot be grown successfully on a shallow soil. Rather, pastures should be established that will both retard runoff of storm waters and withstand irregularity of moisture supply.

In fact, the results obtained in the investigations conducted on the Regional Experiment Stations indicate clearly the need for correct land usage on each area of a farm. This involves retaining the deepest and most fertile permeable soils for use in growing high-yielding crops in a rotation that allows the storage of sufficient moisture to provide a "season in the ground" at planting of each crop. The less fertile soils and shallow land on either flats or slopes should be either retired to pastures or used for rotations consisting mostly of pastures and annual leguminous cover crops such as cowpeas.

Such a land use plan would undoubtedly improve the average yields of agricultural crops, conserve the fertility of the soils and increase the number of animals on the farms—all of which would contribute to the development of a sound balanced farm economy in this State.

The Sorghum Midge.

By T. PASSLOW, Assistant Entomologist.

The sorghum midge (*Contarinia sorghicola* (Coq.)) is the major field pest of grain sorghums in Queensland, where its incidence and intensity of infestation vary considerably from season to season. This pest attacks only the flowering heads, injury is confined to the developing grain, and the bulk of damage is initiated whilst the pollen is being shed. Under conditions suitable to the midge, heavy losses may be experienced.

When severe, midge damage can be confused with frost injury and blast; the latter is caused by abnormal summer temperatures, hot winds or drought during the flowering period. Close inspection of midge-affected heads, however, will reveal tiny white pupal cases attached to the tips of many of the florets. Also unlike frost injury and blast, sorghum midge seldom destroys all the grain in a head, as a few of the florets usually escape the attention of the egg-laying females.

As well as grain sorghums, the midge infests sweet sorghums, broom millet, Johnson grass, Sudan grass and to a lesser extent several native grasses.

The adult midge is a fragile fly, much smaller than a common mosquito, with a bright orange abdomen and transparent wings. It seldom lives more than two days, but during this time a female may lay more than a hundred eggs, although usually only one to a floret. On hatching, the tiny maggots feed on and destroy the developing grain, eventually pupate, and finally the adult midges emerge. During summer, the whole life cycle takes about 12 days.

The midge overwinters as fully grown maggots in trash in the sorghum fields, in unharvested heads along fence

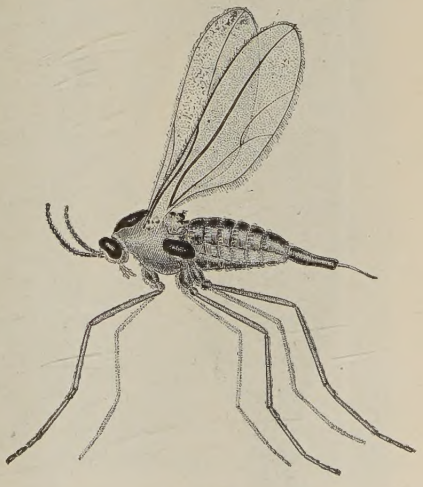

Plate 1.

Adult Female Sorghum Midge Magnified About 10 Times.

lines and headlands, and in the trash and refuse of other hosts which it may infest. When conditions are suitable, these overwintering maggots pupate, and emergence of the adults follows. This occurs about two weeks after a thorough soil wetting followed by two to three weeks of high humidity and moderate temperatures. The intensity of crop damage depends to a large extent on the suitability of conditions for this midge emergence at flowering. Once the midge has emerged the build-up of the pest populations may be very rapid.

In the central districts, where the rainy season is concentrated in late January and February the mid-season crops are damaged, whereas those flowering in March and April often escape the pest. Farther south the wet season is not so well defined, although the peak often coincides with late flowering. In these districts the midge is seldom a pest in early and mid-season crops.

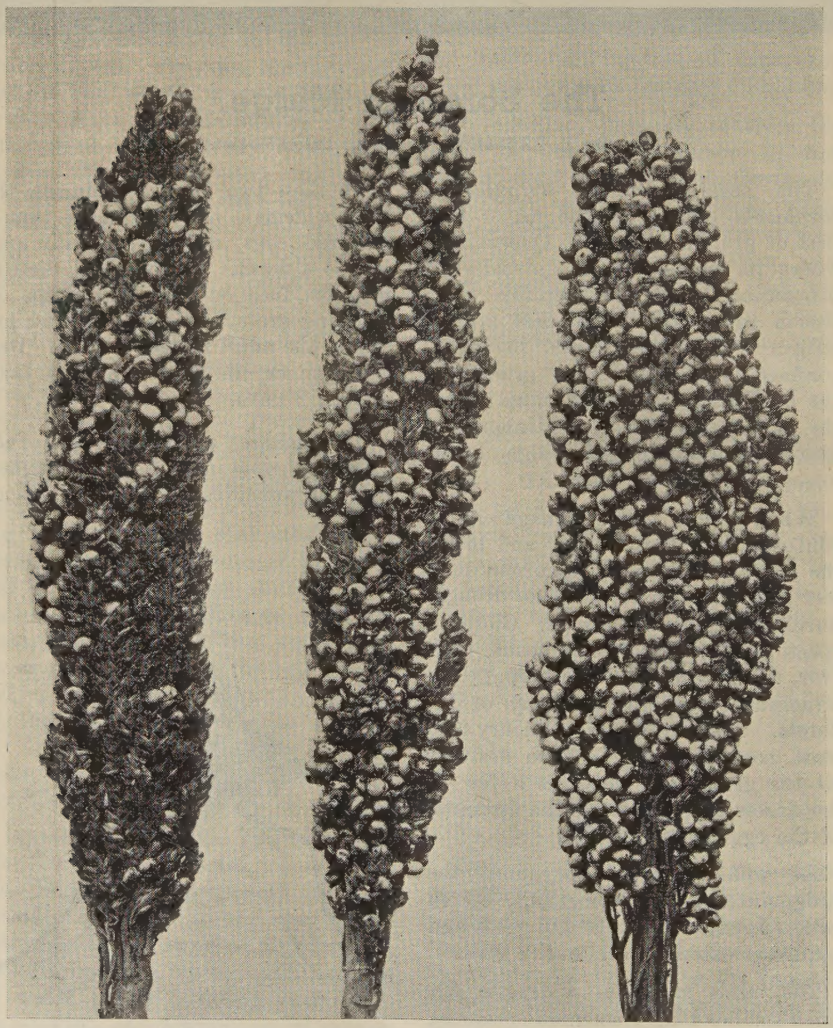

Plate 2.

Sorghum Midge Damage. The head on the right was not affected by midge.

Control Measures.

To avoid midge damage, crops should be planted so that there will be reasonable chances of flowering at times other than during the summer rainy period.

Crops flowering during this period should be watched carefully. Midge is most active on calm, sunny mornings, and if swarms of these tiny orange flies are present, then severe damage can be expected. Spraying with DDT at the rate of 1 lb. active ingredient per acre in not less than 15 gallons of water per acre should result in a 50-60% save in well-grown crops.

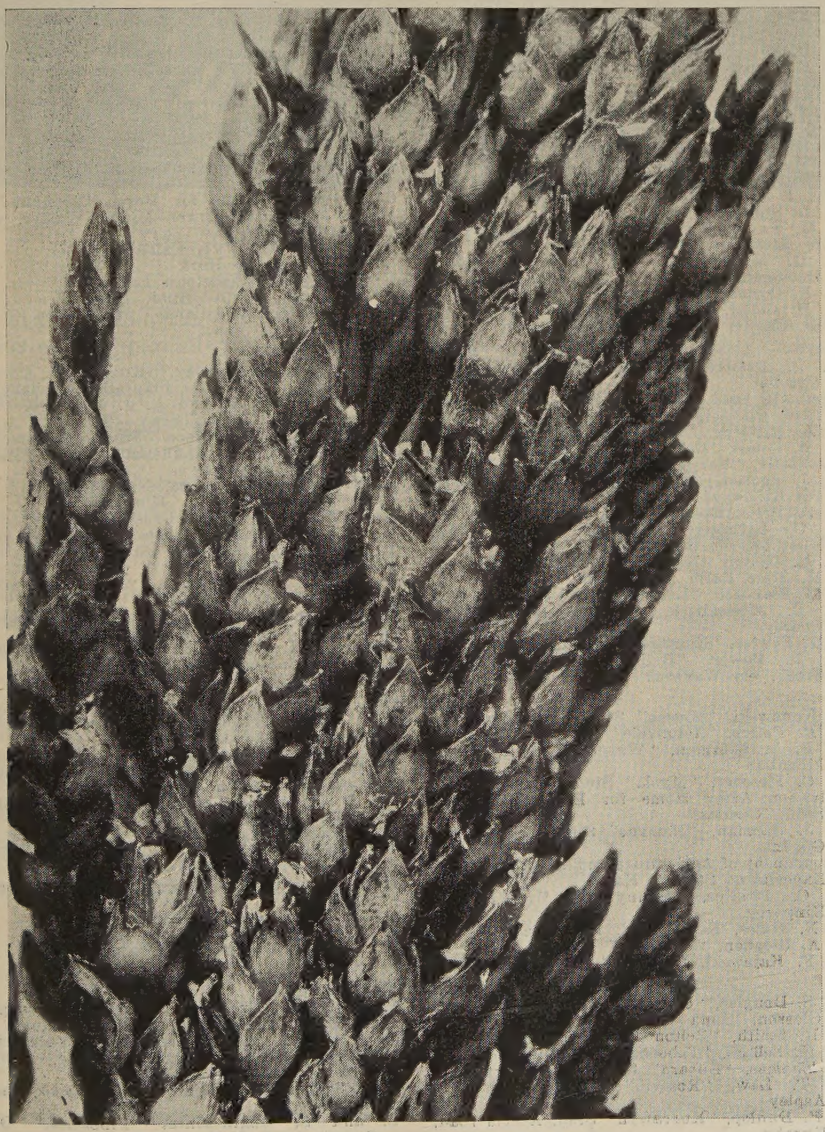

Plate 3.

The Tiny White Pupal Cases on the Tips of the Seed Coverings Enable Midge Infestation to be Distinguished from Frost and Blast Damage.

Brucellosis-Tested Swine Herds.

TESTED HERDS (As at 30th April, 1955).

Berkshire.

A. P. and N. Beatty, "Deepdene," Barambah road, Nanango
S. Cochrane, "Stanroy" Stud, Felton
G. Handley, "Handleigh" Stud, Murphy's Creek
J. L. Handley, "Meadow Vale" Stud, Lockyer
O'Brien and Hickey, "Kildurham" Stud, Jandowae East
G. C. Traves, "Wynwood" Stud, Oakey
E. Tumbridge, "Bidwell" Stud, Oakey
Westbrook Farm Home for Boys, Westbrook
M. K. Collins, "Kennington" Stud, Underwood road, Eight Mile Plains
H.M. State Farm, "Palen" Stud, Palen Creek
A. R. Ludwig and Sons, "Beau View" Stud, Beaudesert
H. H. Sellars, "Tabooba" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trouts road, Aspley
R. H. Crawley, "Rockthorpe" Stud, *via* Pittsworth
F. R. J. Cook, Middle Creek, Pomona
Mrs. I. M. James, "Kenmore" Stud, Cambooya
H. L. Stark, "Florida," Kalbar
J. H. N. Stoodley, "Stoodville," Ormiston
H.M. State Farm, Numinbah
V. G. M. and A. G. Brown, "Burdell," Goovigen
N. F. Cooper, Maidenwell
R. H. Coller, Tallegalla, *via* Rosewood
E. J. Clarke, "Kaloon" Stud, Templin
M. G. and R. H. Atkins, "Diamond Valley" Stud, Mooloolah
L. Puschmann, "Tayfeld" Stud, Taylor
Dr. B. J. Butcher and A. J. Parnwell, "Hartley Grange" Stud, 684 Logan Road, Greenslopes
C. E. Edwards, "Spring Valley" Stud, Kingaroy
G. McLennan, "Murcott" Stud, Willowvale
H. M. Wyatte, "Deepwater" Stud, Rocky Creek, Yarraman
C. F. W. and B. A. Shellback, "Redvilla" Stud, Kingaroy
R. J. Webber, "Webberberry" Stud, 35 Caxton st., Petrie Terrace
J. C. Lees, "Bridge View" Stud, Yandina
F. Thomas, "Rosevale" Stud. M.S. 373, Beaudesert
A. C. Fletcher, "Myola" Stud, Jimbour
Q.A.H.S. and College, Lawes
E. F. Smythe, "Grandmere" Stud, Manyung, Murgon
The Marsden Home for Boys, Kallangur
M. F. Callaghan, Lower Mount Walker, via Rosewood
J. B. Lotz, M.S. 794, Kalbar
G. J. Hutton, Woodford
E. R. Kimber, Coalstoun Lakes
K. B. Jones, "Cefn" Stud, Pilton
A. J. Potter, "Woodlands," Inglewood

Large White.

H. J. Franke and Sons, "Delvue" Stud, Cawdor
Garrawin Stud Farm Pty. Ltd., 657 Sandgate road, Clayfield
J. A. Heading, "Highfields," Murgon
K. B. Jones, "Cefn" Stud, Pilton
R. Postle, "Yarralla" Stud, Pittsworth
B. J. Jensen, "Bremerside" Stud, Rosevale, *via* Rosewood
E. J. Bell, "Dorne" Stud, Chinchilla
L. C. Lobegeiger, "Bremer Valley" Stud, Moorang, *via* Rosewood
H. R. Gibson, "Thistleton" Stud, Maleny
H.M. State Farm, Numinbah
K. A. Hancock, "Laurestonvale" Stud, Murgon
V. P. McGoldrick, "Fairymeadow" Stud, Cooroy
S. T. Fowler, "Kenstan" Stud, Pittsworth
M. D. Power. "Ballinasloe" Stud, Swan Creek, *via* Warwick
H. L. Larsen, "Oakway," Kingaroy
N. E. Meyers, Halpine Plantation, Kallangur
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F. K. Wright, Narangba, N. C. Line
O. B. Vidler, Manneum, Kingaroy
K. F. Stumer, French's Creek, Boonah
Q.A.H.S. and College, Lawes
R. S. Powell, "Kybong" Stud, Kybong, *via* Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
C. Wharton, "Central Burnett" Stud, Gayndah
S. Jensen, Rosevale, *via* Rosewood
Kruger and Sons, "Greyhurst," Goombungee
V. V. Radel, Coalstoun Lakes

Tamworth.

S. Kanowski, "Miecho" Stud, Pinelands
N. R. Potter, "Actonvale" Stud, Wellcamp
D. F. L. Skerman, "Waverley" Stud, Kaimkillenbun
A. C. Fletcher, "Myola" Stud, Jimbour
Salvation Army Home for Boys, "Canaan" Stud, Riverview
A. J. Surman, "Namrus" Stud, Noble road, Goodna
Department of Agriculture and Stock, Regional Experiment Station, Kairi
E. C. Phillips, "Sunny View," M.S. 90, Kingaroy
F. N. Hales, Kerry road, Beaudesert
T. A. Stephen, "Withcott," Helidon
W. F. Kajewski, "Glenroy" Stud, Glencoe
A. A. Herbst, "Hillbanside" Stud, Bahr Scrub, *via* Beenleigh
H.M. State Farm, Numinbah
D. B. Alexander, "Debreczen" Stud, Kinleymore, *via* Murgon
Dr. B. J. Butcher and A. J. Parnwell, 684 Logan road, Greenslopes
G. H. Sattler, Landsborough
F. Thomas, "Rosevale" Stud, M.S. 373, Beaudesert
H. J. Armstrong, "Alhambra," Crownthorpe, Murgon
Q.A.H.S. and College, Lawes
R. H. Coller, Tallegalla, *via* Rosewood
A. J. Potter, "Woodlands," Inglewood

Wessex Saddleback.

W. S. Douglas, "Greylight" Stud, Goombungee
J. Gleeson, "Iona Vale" Stud, Kuraby
C. R. Smith, "Belton Park" Stud, Nara
H. H. Sellars, "Tabooba" Stud, Beaudesert
H. Thomas, "Eurara" Stud, Beaudesert
D. T. Law, "Rossvill" Stud, Trout road, Aspley
J. B. Dunlop, "Kurrawyn" Stud, Acacia road, Kuraby
F. K. Wright, Narangba, N. C. Line
G. J. Hutton, Woodford
R. A. Collings, "Rutholme" Stud, Waterford
W. R. Dean, "Trelawn," Tandur, *via* Gympie
M. Nielsen, "Cressbrook" Stud, Goomburra
G. J. Cooper, "Cedar Glen" Stud, Yarraman
Mrs. R. A. Melville, "Wattledale Stud," Beenleigh road, Sunnybank
A. J. Stewart, "Springbrook," Pie Creek road, Gympie
S. and S. Ouglitchinin, "Pinefields," Old Gympie road, Kallangur
R. J. Hicks, M.S. 98, Darlington, *via* Beaudesert
Kruger and Sons, "Greyhurst," Goombungee

British Large Black.

H. W. Naumann, "Parkdale" Stud, Kalbar

The Washington Navel Orange.

By S. J. KUSKIE, Adviser in Horticulture.

The Washington Navel orange (Plate 1) apparently arose as a bud sport from the Selecta orange in Brazil, where it was propagated under the name Bahia orange in the early nineteenth century.

The United States Department of Agriculture imported 12 trees into Washington about 1870 and the variety was later distributed to California, Florida and other parts of the world under the name Washington Navel.

The Bahia orange was reputedly brought to Australia as early as 1850, but the type introduced was apparently a poor strain. The true Washington Navel was, however, established at Renmark in South Australia during the year 1890. One of the original trees is still in existence; it is on orange stock.

Development.

The development of the Washington Navel orange by the selection of bud sports has been going on for a long time. Many strains have been propagated, some being of great importance to the citrus industry while others are of little commercial value. Individual strains differ in both internal and external fruit characters. Some have been developed in Australia and accepted commercially. They include the Leng, Bellamy and Dunning.

The Leng Navel originated at Irymple in Victoria and is, in some respects, superior to the original Washington. The oldest worked trees of this variety are now some 14 years old. Under Victorian conditions, the fruit quality of the Leng is high; it has a finer skin than the Washington, less rag, more juice and an earlier maturing period. The flavour is also better and the mature fruit hangs longer on the tree. Its performance in Queensland has still to be assessed before large-scale plantings can be recommended.

The Bellamy Navel is a fruit with a characteristically small navel.

The Dunning Navel was developed in the Palmwoods district and has no particular attributes other than the high quality of the fruit.

Tree Characteristics.

The Washington Navel tree has an umbrella-shaped crown and the leaves are normally larger and darker green than those of other citrus varieties.

The relatively large white flowers are produced in the spring blossoming period, which lasts from four to six

weeks depending on seasonal conditions. Only a small percentage of the flowers set and there is a typical shedding of young fruit during November. The crop ripens between March and May, and the trees hold the mature fruit for a month or more.

The profitable life of the Washington Navel orange tree is governed by a number of factors, such as soil type, climatic conditions, disease incidence and methods of orchard management. Long-lived trees are rare. Under good conditions, fruiting begins within three years from budding and yields increase annually until the tree is 15 years old. From then on, yields gradually decline. It is unusual to find a productive tree over the age of 40 years.

Plate 1.

Washington Navel Orange Tree, One of the More Important Varieties of Citrus Grown at Gayndah. The crown is umbrella-shaped and the skirt of the tree almost touches the ground.

Fruit Characteristics.

The fruit is parthenocarpic (that is, it develops without fertilisation of the flower). It is deep orange in colour, somewhat rounded in shape, relatively thick skinned, large (2¼-3½ inches in diameter), with a medium to large navel. The juice sacs are large, with a medium to abundant supply of juice and few seeds.

The Washington Navel orange is popular on the fresh fruit market. To the processor, however, it presents a problem because the flavour of the juice deteriorates after extraction.

Climatic Requirements.

In eastern Australia, the Washington Navel orange grows between latitudes 11° and 38° south at altitudes from sea level to 800 feet. The two main requirements for the variety are an adequate supply of moisture and freedom from frosts. Ample water is essential in spring just prior to blossoming, in midsummer and again in February or March as the fruit matures. Frequent irrigation is associated with consistent bearing and high yields.

The Washington Navel orange crops best in areas where the summers are hot and the winters are cool. It is therefore better suited to sub-coastal

and inland districts rather than the coast. In humid coastal areas, setting is generally poor and the fruit is usually spherical in shape; in the drier inland areas, setting is normally good and the fruit tends to be oval.

Rootstocks.

The majority of Washington Navel trees in Queensland are worked on rough lemon stocks and the remainder are mainly on sweet orange stocks. Rough lemon stock tends to increase the amount of limonin (the bitter principle) in the juice and accentuates granulation and drying of the fruit sacs. It also is rather susceptible to root rots and gumming. Sweet orange stock is more resistant to root rots and gumming than rough lemon, and trees worked on this stock are less subject to granulation of the fruit.

Bitterness of the juice and granulation of the fruit are less pronounced in Washington Navel trees propagated on trifoliata stock. This stock is also highly resistant to gumming and root rots. Scaly butt virus can, however, be troublesome unless the trees have been propagated from budwood derived from mature, virus-free trees established on trifoliata stock.

Pruning and Training.

Young trees should be headed 18 to 24 inches above the ground. Early training and pruning consists in the removal of inside shoots so as to encourage the outward development of the laterals which later form the framework of the mature tree.

Pruning practice in bearing trees aims at keeping the centre of the tree open with a canopy of fruiting wood on the outside. Limbs which tend to grow downwards are retained, as they provide shade for the trunk and the ground under the canopy. Pruning is carried out during the winter months soon after the crop is harvested. Heavy pruning is seldom necessary.

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Bananas—Aftermath of the 1954 Cyclones.

By J. A. MOBBS, Adviser in Horticulture.

Banana growers in southern Queensland have good reason to remember 1954, as it was in this year that two of the worst cyclones in the history of the industry were recorded. The first occurred on February 19-20 and was accompanied by 8 inches of rain. The second extended from July 9 to July 13, during which period 17 inches of rain were registered at Nambour. On each occasion, winds reached a very high velocity.

Prompt action after the cyclones did much to remedy the damage and in many plantations the recovery has been nothing short of spectacular. Nevertheless, part of the area under crop was totally destroyed and normal production cannot be expected until such time as new plantings come into bearing.

The Damage.

The banana plant is more susceptible to injury than most other cultivated crops when subjected to excessive rain and strong winds. Contributory factors are:

(*a*) *The shallow root system.*—The long, fibrous roots are thin and fleshy rather than woody, and are usually situated close to the surface of the soil. The liability to wind damage is, of course, accentuated if the root system is weakened by fungal rots or by beetle borer infestation in the corm.

(*b*) *The weak stem.*—The pseudostem (generally referred to as the trunk) is not a true stem but consists of overlapping leaf bases. It is frequently incapable of supporting a heavy bunch under normal conditions, let alone in cyclonic weather, unless supported by props.

(*c*) *The broad leaves.*—The leaves of the banana plant are broad, undivided and characteristically bunched together. Wind resistance is consequently high and this places a considerable strain on the pseudostem and root system during periods of high winds.

The gale force winds of the February cyclone caused widespread devastation and only plantations which were exceptionally well sheltered escaped serious damage. The general consensus of opinion is that the February cyclone caused more havoc than that in the following July but it is difficult to make accurate comparisons. On the North Coast between Landsborough and Gympie, however, the cyclonic winds in July came from a different direction to those in the February cyclone; they not only battered areas which more or less escaped damage in February, but also ruined some areas which were being re-established. Consequently, quite a number of growers were obliged to write off their existing plantations and replant at the first opportunity.

The nature and extent of the damage varied from plantation to plantation. Though these differences sometimes appear inexplicable, they could in part at least be attributed to factors which influence the stability of the plant such as (*a*) natural protection from wind; (*b*) soil type; (*c*) age of the plantation; (*d*) the proportion of plants carrying bunches at the time; and (*e*) propping methods.

Young Plantations.

In young plantations, the leaves were badly shredded and twisted, and many plants listed away from the direction of the cyclonic winds (Plate 1). Probably more important, though less obvious, was the damage to the root systems caused by the bodily movement of the plants. This in all probability was responsible for the small

Plate 1.

Young Banana Plantation after the February, 1954, Cyclone. Note the shredded leaves and listing stems.

size and poor quality of plant crop bunches thrown in winter and spring subsequent to the cyclones. Many of these bunches had little or no commercial value.

Relatively few plants were broken or uprooted in young plantations. The setting of the suckers therefore did not present a major problem to growers who practise crop control, as suckers were available from which suitable types could be selected for the production of winter and spring fruit.

Most of these plantations are now producing average bunches with fruit of normal quality.

Bearing Plantations.

Many bearing plantations presented a scene of desolation after the cyclones, as practically all plants carrying bunches were razed to the ground. Some snapped several feet above ground level, whilst others were totally uprooted (Plate 2).

Where the pseudostems had broken, only bunches with well forward fruit at the time of collapse could be salvaged, the balance being a total loss. In such plants, however, the majority of the suckers were undamaged and re-establishment of the area was achieved by cultural methods designed to speed up the development of the previously selected follower. Where this follower had itself been damaged, a fresh sucker was set in its place. This substitute sucker, when treated well, was usually sufficiently forward to produce further suckers in the September-November period from which a suitable follower could be selected to bear a ratoon crop in autumn and winter, 1956.

When plants were partly uprooted, the majority of the bunches approaching maturity were salvaged. Those which were listing badly were supported by means of double props, but plants close to or on the ground were allowed to remain in position. In both cases, bunch covers were used as a protection against sunburn damage. Covering the butts with soil was also practised, more perhaps as a

Plate 2.

Bearing Banana Plantation after the February, 1954, Cyclone. Some are uprooted; in others the stems have snapped off above ground level; the balance have keeled over away from the wind.

means of minimising beetle borer infestation than anything else. A surprisingly large number of bunches was salvaged by these methods.

Attempts to re-establish uprooted plants met with little success. When they were brought back into an upright position and replanted, suckers which had been set before the cyclones remained practically dormant during the winter and many succumbed to beetle borer attack.

In some plantations which were carrying plant crop bunches at the time of the February cyclone, the damage was so severe that once the worthwhile fruit was salvaged, growers did not attempt to rehabilitate the crop.

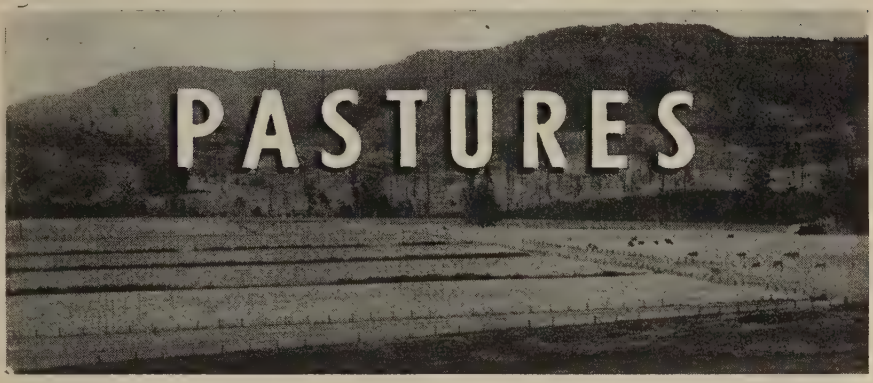
Pests.

One noticeable feature in many plantations affected by the 1954 cyclones was the conspicuous increase in beetle borer damage. This was probably due to the large number of broken and uprooted stems which littered the ground and provided harbourage for the pest. Success in re-establishing a damaged plantation depended to a great extent on the efficiency with which the grower controlled the insect by cutting and splitting the spent stems, by consistent baiting and by the adoption of cultural measures designed to promote rapid plant growth.

Future Production.

The overall decrease in banana production caused by the 1954 cyclones does not give a true picture of the financial loss. Considerable expenditure has been incurred in establishing and tending new plantations to replace those which were destroyed in the early stages of their productive life. Nevertheless, judging from the area planted during the 1954-55 season, production should soon be restored to its former level.

One noticeable feature in some districts is the preference shown in new plantings for Cavendish as against Mons Mari, a taller variety which has been making strong headway in southern Queensland during recent years. The change reflects the generally more severe damage caused by cyclonic winds in Mons Mari, although on most types of soil the latter would generally be rated as the superior variety in terms of both yield and fruit quality.



Guinea Grass.

By OFFICERS OF THE AGRICULTURE BRANCH.

A native of Africa, Guinea grass is now naturalised in most wet countries within the tropics and is used extensively for forage purposes in South America, the West Indies, Africa, the East Indies, south-eastern Asia, etc. Guinea grass has been established for many years in Queensland and is fairly common under both wild and cultivated conditions along the coastal strip.

Varieties of Guinea Grass.

The forms of Guinea grass at present cultivated in Queensland have been separated into the following three main types:—

(1) Common Guinea grass (*Panicum maximum* var. *typica*).

(2) Green panic or slender Guinea grass (*Panicum maximum* var. *trichoglume*).

(3) Purple-top Guinea grass (*Panicum maximum* var. *coloratum*).

These all grow in clumps which often reach a height of several feet, and they give a tussocky type of pasture. Common Guinea grass is a very robust grass with coarse stems; green panic is a fine-stemmed form, and purple-top Guinea grass is intermediate in habit between these two.

Green panic grass is now being widely used in sub-coastal districts of south and central Queensland. It is convenient, therefore, to treat this as a distinct pasture species. It is dealt with in detail in Advisory Leaflet No. 225 which is available free of charge from the Department.

The third main type, purple-top Guinea, has never been widely used on farms in Queensland. While it is not as productive as common Guinea grass, it does show the same coarse tussocky habit of growth. It thus lacks some of the main virtues of both common Guinea and green panic, and is not likely to become a major pasture grass in this State.

It is with common Guinea grass, therefore, that the present paper will deal. The grass which we know by this name has now been naturalised in Queensland for very many years, and is a uniform grass type. Other varieties of coarse Guinea grass have been introduced from time to time and tested against this local strain. Up till 1941, however, none of these introduced strains proved the equal of the local strain in total yield of good leafy forage.

Many other strains of Guinea grass have since been introduced and are in various stages of testing. While

Plate 1.

A Pasture of Guinea Grass and Stylo at the Bureau of Tropical Agriculture, South Johnstone. This pasture has been established for some years, and maintained successfully under a system of rotational grazing.

Plate 2.

Encroachment of Centro into a Guinea Grass Pasture. This pasture was established as a mixture of Guinea grass and stylo, but centro invaded portions of the plot, giving a good mixture of legume and grass.

a few of these have shown distinct promise, none has yet been liberated as a better pasture grass than the common Queensland strain.

Common Guinea Grass.

In old established stands, common Guinea grass shows a typical stool-forming habit, with strong seasonal leafy growth occurring from both the centre and the outside of the stool (Plate 6). Long seed stalks, often 5 to 6 feet high, carry the inflorescence, which takes the form of an open, drooping panicle. The small seeds are enclosed in hulls or glumes which are smooth and hairless.

Flowering and seed setting commence at the outer ends of the branches, and the complete flowering period for one head may extend over a week to ten days. Unfortunately, the seeds tend to shed as they mature. This makes the harvesting of high quality seed a somewhat difficult process, and the present minimum germination required under the Seeds Acts is only 3%.

The dense fibrous root system enables the stools to withstand long periods of dry weather, and once established the grass is undoubtedly a hardy species.

Climatic Requirements.

Guinea grass thrives under warm, moist conditions and in Queensland its maximum growth is made during the summer wet season. Although the grass reaches its maximum productivity along the coastal belt from Rockhampton northwards to the Daintree, useful stands are to be found in south-eastern Queensland, particularly

Plate 3.

A Guinea Grass and Centro Pasture at South Johnstone. The presence of the legume in this mixture has maintained the grass in a lush green condition, enabling stock to keep it well grazed.

Plate 4.

A Guinea Grass Pasture on Red Scrub Soil in the Innisfail District. This pasture contains various legumes with the Guinea grass, and provides a good stable mixture after many years of grazing.

in areas not subject to heavy frosting. Severe frosts will weaken or actually kill the grass; its use should therefore be confined to areas free from heavy frosting.

A very desirable feature of Guinea grass is its ability to grow under shade. This shade tolerance enables it to germinate and grow under lantana or other vigorous weed growth. Eventually the grass provides sufficient bulk to take a good fire, which destroys the weeds and allows their replacement by the grass.

Soils.

Guinea grass is adapted to a wide range of soil types. It is frequently found growing, and apparently thriving, on railway cuttings and embankments where the soil is shallow or of low fertility. For pasture purposes, however, Guinea grass should be confined to relatively fertile soils. Guinea grass will grow to perfection on tropical rain-forest hillsides, following the clearing and burning of the scrub. On such well-drained soils of medium to good fertility, high stocking rates can be maintained, particularly if a suitable legume is grown with the grass.

Inferior soils produce only a weak stand of Guinea grass, especially under conditions of heavy stocking. Without adequate fertilization such stands may be quickly overgrown by weeds. Fertilizers containing nitrogen and phosphates may profitably be used on Guinea grass to increase seasonal productivity. However, recent work in North Queensland has shown that

on a variety of soil types excellent productivity can be maintained if a vigorous tropical legume such as centro is incorporated in the pasture mixture.

Provided the drainage is good, Guinea grass will maintain excellent growth on highly acid soils.

Planting.

Where suitable seed can be purchased with a 3% germination, planting at a rate of 6 to 8 lb. per acre is recommended, particularly where quick establishment is required after scrub burns. Where the germination percentage is higher, a lower planting rate can be used—for example, 4-5 lb. per acre for seed with a 5% germination.

Sowings should be made during early spring or in late summer so that the young seedlings are not subjected to extreme heat after germination.

Small areas may be established by the planting out of rooted pieces obtained from mature stools. Plantings in this manner are usually made in rows 3 ft. 6 in. to 4 ft. apart, with a distance of 2 ft. between plants in the row.

Extensive investigations in North Queensland have shown that Guinea grass can be successfully planted in association with such tropical legumes as centro and calopo.

Management.

In other tropical countries where it is grown, Guinea grass is rarely grazed but is normally cut by hand and fed as "chop-chop" to livestock. With this form of cutting management, high productivity with grass yields of 30 to 50 tons per acre per annum have been recorded.

In Queensland, Guinea grass is usually grazed by cattle, though its use as "chop-chop" for feeding farm horses in the northern cane-growing areas is common.

Heavy continuous stocking of Guinea grass should be avoided. To maintain a permanent stand the grass should be allowed to seed at least once in two years. Guinea grass provides good grazing if not allowed to become too coarse.

Stools should not be eaten or mown below an irregular height of 9-12 in., as the starch reserves in the stems are quickly depleted if the grass is kept closely grazed. This will result in poor regrowth. Plant food reserves are normally maintained in the stools, as the grass has only a fibrous rooting system. This feature is in distinct contrast to many sward-forming grasses which are well supplied with suitable root storage organs.

Rotational grazing systems can be satisfactorily used with Guinea grass pastures. Under tropical conditions

TABLE 1.

Typical Analyses of Guinea Grass.

Description of Sample.	Analysis of Water-free Material.						
	Crude Protein.	Crude Fat.	Carbo-hydrates.	Crude Fibre.	Ash.	CaO.	P_2O_5
	%	%	%	%	%	%	%
Wet season ..	13·3	1·3	41·8	34·1	9·5	0·599	0·437
Dry Season ..	8·1	1·0	46·3	35·9	8·7	0·475	0·461
Young leafy growth ..	13·1	0·9	..	25·8	..	1·278	0·757
Old stemmy growth ..	4·5	0·6	..	39·7	..	0·410	0·148

Plate 5.

Guinea Grass Pasture on the Palmerston Highway, Innisfail District.

Plate 6.

A Guinea Grass Clump at Utchee Creek, Innisfail District. This close-up shows the coarse tussocky nature of the grass. Grazing of these clumps gives a "table-top" effect.

at the Bureau of Tropical Agriculture at South Johnstone, paddocks of Guinea grass and centro are in good condition after seven years' management on a basis of 7 days' successive grazing followed by 28 days' spelling. Stocking has been at the rate of one beast to 1¼ acres and no deterioration of the Guinea grass stand has been observed.

The use of centro with Guinea grass has resulted in a marked improvement in the colour, vigour, leafiness and palatability of the grass, due to the increase in soil fertility. This pasture mixture, Guinea grass and centro, is one of the outstanding combinations so far developed at the Bureau of Tropical Agriculture for use in high-rainfall tropical districts. A good mixed pasture may be obtained by seeding centro at the rate of 2-4 lb. per acre in combination with the recommended grass sowing.

Feeding Value.

This grass is very palatable to stock and the young grass has a high feeding value. Nutritious feed is provided also by Guinea grass hay and silage cut at the right stage. Table 1 gives chemical analyses of four average samples of the grass under various Queensland conditions.

Conservation.

Guinea grass makes an excellent hay if cut at the flowering stage. Only a small quantity of hay or silage is made in Queensland, however. This is due mainly to the mechanical difficulty of mowing and raking such a coarse tussocky grass. This difficulty is

Plate 7.

Scrub Clearings Under Pasture at Utchee Creek, Innisfail District. The foreground is covered with Guinea grass and the background slope with molasses grass.

accentuated where the plant stools are maintained at a height of 9-12 in. in order to prevent depletion of plant food reserves.

Productivity.

The total annual yield of Guinea grass pastures when under rotational grazing has been as high as 23 tons per acre on a green weight basis.

Seed Production.

The mechanical harvesting of Guinea grass seed has never been seriously considered in the past. One important reason for this is that much of the country on which seed is produced in North Queensland is rough or steeply sloping. Other undesirable features from the viewpoint of machine-harvesting are the uneven ripening of the seed and the early shedding of mature seed.

At the present time, therefore, all the Guinea grass seed which reaches the Queensland market is the result of hand-harvesting and hand-threshing. This seed is derived mainly from the Kuranda, Myola and Innisfail districts of North Queensland.

It is highly probable that direct mechanical harvesting would be practicable in the Burdekin district, where the grass grows prolifically on the flat Delta soils.

It is recommended that Guinea grass seed be held for a period of some months before planting. Freshly harvested seed may show a very low germination or, at times, no germination at all. However, it has been found that careful storage may effect a marked improvement in samples which were originally of very doubtful value.

Plate 8.

The Use of Guinea Grass to Control Lantana in the Mackay District. This picture, taken following a burn, shows the prolific growth of the Guinea grass amongst the dead lantana.

Seed counts show that there are approximately 884,500 seeds per pound. At a planting rate of 5 lb. per acre, seed with a germination rate of 3% would give a seeding density of 3 good seeds per square foot.

Use in Weed Control.

It has been mentioned earlier that Guinea grass will germinate and grow under lantana and other vigorous tropical weeds. This valuable characteristic, coupled with its capacity to recover well after burning, has provided a most effective means of weed control. This method has been used with marked success in the control of dense lantana on dairy lands in the Mackay coastal district.

In these areas a mixture of equal parts of Guinea grass and green panic has been most commonly used in such reclamation work. This mixture, applied at the rate of 4 lb. per acre during the wet season, will normally give an effective cover of grass which will set seed before winter. Moreover, if such a mixture is planted along the top of a ridge and allowed to seed freely, the grass will quickly spread down through lantana-covered slopes.

The whole area is fired at a suitable time, after a good body of grass has developed and seeded down. If a good clearance of the lantana is not effected in the first burn, firing is continued in subsequent years until the land is completely reclaimed by the grass.

For further details, reference should be made to Advisory Leaflet No. 207, entitled "Control of Lantana by Cultural Methods in the Mackay District."

Undesirable Features.

Guinea grass on test has been shown to contain traces of the prussic acid compounds which often cause trouble in various plants of the sorghum group. However, it is unlikely that any positive cases of cattle poisoning from the grazing of Guinea grass have been recorded in Queensland.

Under some cultivation conditions, such as where ratoon crops of sugar cane are grown, Guinea grass may become something of a weed on headlands and other vacant areas. Stock are not usually carried on such properties and only cultivation and burning practices can be used to control the rather prolific growth occurring under the wet tropical climatic conditions.

RENOVATING COOROY DISTRICT PASTURES.

Invasion of dairy pastures on steep slopes in the Cooroy district by poor grasses and bracken fern is being halted by applying a combination of soil conservation measures, fertilizer application and pasture renovation.

Work by officers of the Department has shown that paspalum will re-establish itself on mat grass and blady grass areas on the poorer soils when the paddocks are mown, roughly ploughed, pasture furrowed and then topdressed with superphosphate. It has been found also that, after renovation and topdressing, oversowing with red and white clovers improves the yield of the pasture.

On cultivated areas, including gentle slopes, a stand of good pasture can be established by planting a mixture of green panic and centro. On areas where drainage is poor, para grass grows well.

On basalt soils on steep slopes, where the grade will permit pasture furrowing, molasses grass and centro can be established in the furrows, assisted by moderate applications of superphosphate. These species show definite promise of suppressing the bracken fern and blady grass.

A Timber Rake Attachment for a Bulldozer Blade.

By W. J. ROCHE, Adviser, Agriculture Branch.

In recent years, greatly increased interest has been shown in pasture improvement in grazing country. One of the most important requirements for pasture establishment, as for crop planting, is a well prepared seedbed. Whether it is proposed to establish a proper seedbed, or merely to prepare grassland for such operations as sod-seeding and mowing, effective land clearing is essential.

The economics of land clearing has therefore become an important factor in current developmental programmes. The attachment described in this article has proved itself an efficient unit in the land clearing process, and may have many applications throughout the State.

Many areas being cleared are carrying standing dead timber as an aftermath of ringbarking or poisoning. Dozing down of these dead trees results in shattering and scattering of limbs and twigs. Saplings, branches and accumulated litter are frequently left on the area when larger tree trunks and stumps are dozed together for burning.

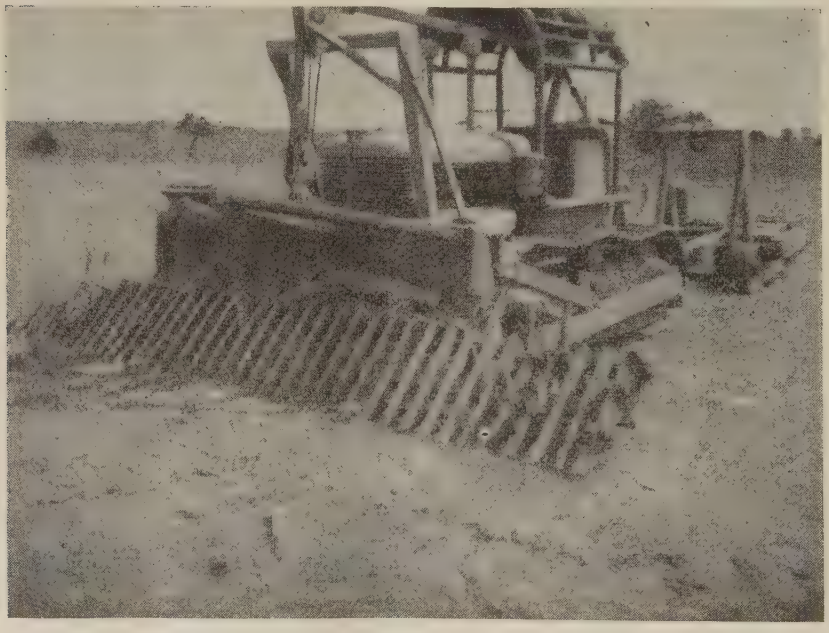


Plate 1.

The Rake Attachment Fitted to the Dozer Unit.

Clearing of this litter has to be carried out prior to the initial cultivation. To eliminate costly manual labour in the secondary clearing, a rake attachment (as described below) has been developed for attachment to the standard dozer blade for the collection of the litter for burning.

The construction of such a rake will naturally vary in relation to local conditions, particularly the type of litter to be handled and the nature and topography of the country. Greater strength and rigidity will be required where the litter is dense and heavy, or where the country is uneven or strewn with boulders. The width and weight of the rake attachment will of course be limited by the size and power of the bulldozer unit to which it will be attached.

The rake illustrated is attached to the dozer blade on an H.D. 10 tractor and the following constructional dimensions have proved satisfactory on this unit.

The width of the rake is 18 ft. with the tines spaced approximately 4 in. apart. The tines are constructed of

Plate 2.

A Close-up of the Rake Tines. Note the hardened steel facings bolted to the tine points; also the welding of each tine to the three supports. The method of fastening the shoe uprights to the tines is clearly visible.

1½ in. x 3 in. x 1 in. steel and are tipped with hardened steel facings. These tips are bolted on for eventual replacement when worn (Plate 2).

The tines are welded to three supports extending the full length of the rake. In this particular unit the lower member was of 3 in. x 1 in. steel while the top two were railway lines.

The rake is attached directly to the side of the dozer blade, and from each end of the rake supports are carried back and attached to the dozer arms to ensure rigidity of the rake extremities (Plate 3).

Two sets of twin shoes (Plate 4) are fitted to the rake. One set of these shoes is located on each side of the dozer blade, between the end of the blade and the outside edge of the rake. Each shoe carries two upright arms which are bolted rigidly to a suitable tine. These shoes are an important feature of the construction, since they are adjusted so as to carry the tine points just clear of ground level. They must be strong and rigid enough to bear the combined weight of blade and rake.

A significant feature of such a unit is that no surface soil is pushed into the timber heaps. This is an important consideration from the viewpoint of minimising soil disturbance as well as that of ensuring an effective burn.

The unit here described was built at a country engineering workshop for approximately £150 (1954 figures).

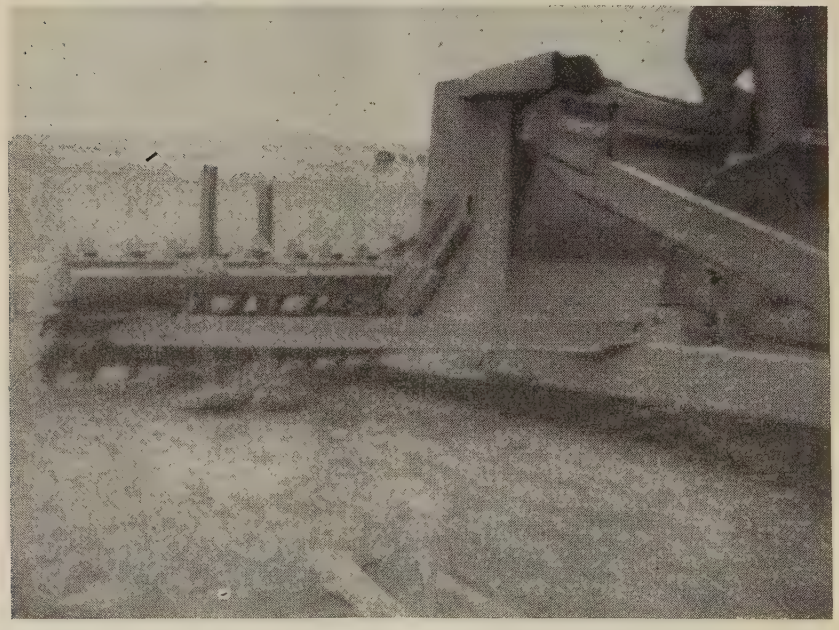


Plate 3.

A Rear View of One Side of the Rake. This view shows the attachment of the rake to the side of the dozer blade, also the brace from the rake extremity to the dozer push-arms.

Plate 4.

The Carrying Shoes Fitted to the Rake. These shoes are turned up both front and rear, to allow forward or backward movement.

POPULARISING THE AVOCADO.

Officers of the fruit preservation laboratory in the Department of Agriculture and Stock have established that the flesh of the avocado can be preserved satisfactorily as a frozen paste, the Minister for Agriculture and Stock (Hon. H. H. Collins, M.L.A.) said recently.

Avocado pastes of about 30 different formulations were prepared as an experiment with the possibility of their use as savoury or sandwich fillings. Immediately after blending, the jars of paste were quick frozen and held at 32° below freezing point for periods of up to 18 months. The jars are being tested for palatability in order to determine the most acceptable recipe.

In the preparation of the pastes discolouration was prevented by the addition of vitamin C and lemon juice, both of which would improve the nutritive value.

The Honey Flora of South-eastern Queensland.

By S. T. BLAKE (Botanist) and C. ROFF (Adviser in Apiculture).

(*Continued from page* 196 *of the April issue.*)

Lucerne.

Botanical Name.—*Medicago sativa* L.

Other Common Name.—Alfalfa.

Distinguishing Features.—A plant with erect soft stems, leaves consisting of three leaflets, and spikes of small purplish-blue pea-like flowers (Plates 116-117). Usually seen as a crop.

Plate 116.

Lucerne (Medicago sativa). Irrigated field in the Lockyer Valley.

Plate 117.
Lucerne (Medicago sativa).

Description.—This plant has a deep taproot and a stout rootstock from which arise numerous erect branched stems up to 4 ft. or more high. Each leaf consists of 3 leaflets attached to the end of a stalk. These leaflets are rounded at the top and narrowed to the base, up to about 1 in. long. The flowers are purplish blue, shaped like those of a pea, nearly ½ in. long, and borne in small spikes on the upper part of the plant. The seed-pod is small and coiled.

Distribution.—Cultivated as a forage crop, sometimes found as an escape along roadsides. It is a native of Europe.

Usual Flowering Time.—December-February.

Colour of Honey.—Water white.

Importance as Source of Honey.—Minor to major.

Importance as Source of Pollen.—Minor to medium.

General Remarks.—This cultivated crop when allowed to flower is a good nectar- and pollen-producer. There is usually no difficulty in obtaining apiary sites near fields where seed lucerne is grown, as most farmers are aware that pollination is assisted by honeybees.

The choice honey has fair density and an unusual slightly acid but pleasant flavour. It granulates quickly with a hard, fine grain.

Rough-barked Ribbon Gum.

Botanical Name.—*Eucalyptus huberiana* Naud.

Other Common Names.—Blue gum, manna gum, ribbon gum, white gum.

Distinguishing Features.—This is a tree with smooth patchy bark on the upper part and rough grey scaly bark on the lower part, long narrow drooping green leaves, flowers in clusters among the leaves, buds with a pointed lid about as long as the lower part, and nearly cup-shaped seed-capsules with protruding valves. The tree often looks like a blue gum, but the rough bark is more scaly and usually extends

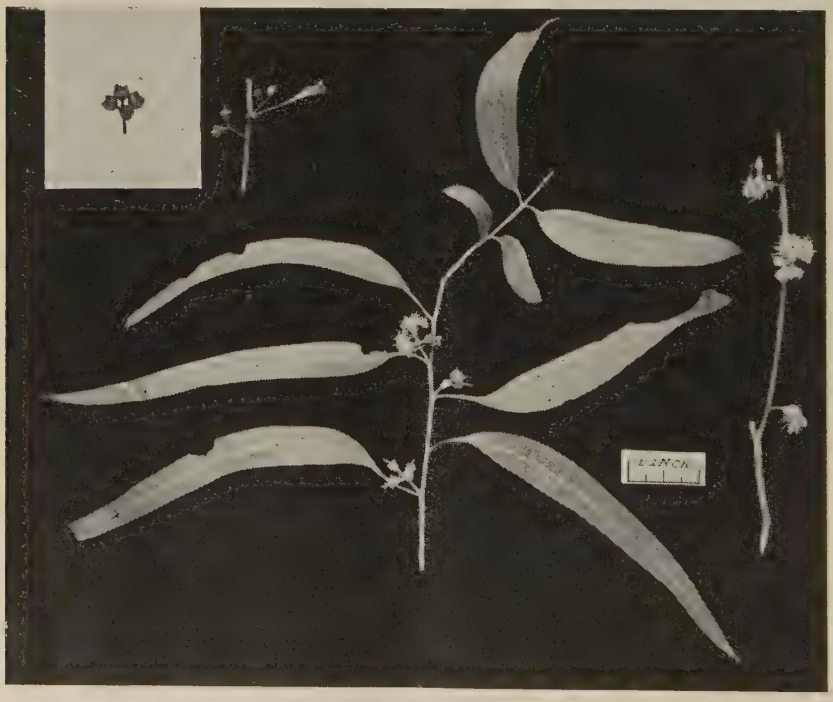


Plate 118.

Rough-barked Ribbon Gum (Eucalyptus huberiana). Leaves, buds, flowers and seed-capsules.

Plate 119.

Rough-barked Ribbon Gum (Eucalyptus huberiana).
Portion of trunk.

Plate 120.

Rough-barked Ribbon Gum (Eucalyptus huberiana).
Cunningham's Gap.

for a much greater distance up the trunk, the lid of the bud is shorter in proportion, and the seed-capsule is more cup-shaped. The sucker leaves are very different (Plates 118-120.)

Description.—This is a tree up to 100 ft. high. The bark is smooth and greyish (often with darker grey patches) over most of the tree, with some grey scaly bark for a few feet above the butt; sometimes the rough bark extends for quite a distance up the trunk. The twigs are slender and tend to droop. The leaves are green on both sides, scattered and drooping with long stalks, long and narrow, mostly 4-7 in. long and at least 6 times longer than wide. The sucker leaves are also green, but otherwise they are very different; they are much smaller, stiffly spreading, heart-shaped, without any stalk and arranged in pairs along the stem. The flowers are borne in small stalked bunches among the leaves, about ½ in. wide when open, white in colour. The bud is stalked with a nearly conical lid about as long as the lower part. The seed-capsules are nearly cup-shaped, with a band at the top and protruding valves, in all about ¼ in. long and somewhat narrower.

Distribution.—The tree occurs in scattered stands in the Darling Downs District on the western slopes of the Main Range and its spurs. It extends south to Victoria and South Australia.

Usual Flowering Time.—March.

Colour of Honey.—Medium amber.

Importance as Source of Honey.—Medium.

Importance as Source of Pollen.—Medium.

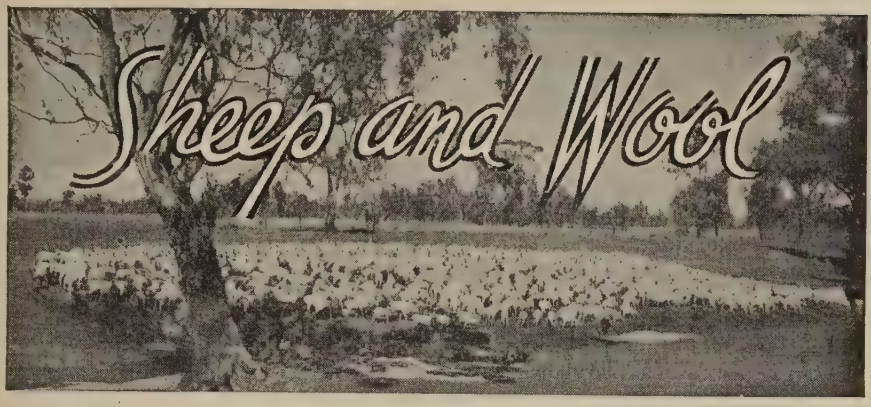
General Remarks.—This tree is useful as a supporting nectar- and pollen-producing species amongst the better-class honey flora. In some favourable seasons it yields large supplies of nectar and whitish pollen and thus strengthens colonies for wintering. Care should be exercised in assessing the flowering time of this species, as buds may hang for some considerable period before breaking.

This first-grade honey has good flavour and fair density, and candies slowly with a coarse brownish grain.

(TO BE CONTINUED.)

STORING SORGHUM GRAIN FOR STOCK.

Where grain sorghum is to be held for a drought reserve, tank or bin storage is the only safe means. Weevils can be effectively controlled in non-airtight tanks by dusting the grain with a 1.5 per cent. BHC dust (0.2 per cent. gamma isomer) at the rate of 2 oz. of dust per 100 lb. of grain. Grain treated with BHC should not be fed to poultry. If fumigation with carbon bisulphide is preferred, the storage must be airtight. Best results are obtained by using 4-5 lb. of carbon bisulphide per 1,000 gallons of filled storage space and fumigating when the temperature is above 70 deg.



The Supplementary Feeding of Sheep in Queensland.

Part I. Introductory.

By G. R. MOULE, Director of Sheep Husbandry.

One of the advantages of the pastoralist's way of life is that nature looks after the feeding of the sheep. But every pastoralist is aware of the vagaries of the season. Queensland's sheep country has seen drought years succeed years of plenty with almost monotonous regularity. As a result, heavy losses of sheep and wool have occurred. Many woolgrowers can recall the disastrous years of 1926 to 1935, when severe drought losses and low wool prices combined to make wool growing uneconomic.

Plate 1.
Sheep in the Mulga Country.

Although the losses caused by drought are spectacular, they may not be the most serious that occur in Queensland's pastoral country. The losses of wool and lambs due to the partial droughts that occur during the latter part of each year may be far more important, although they are seldom recognised. There the several ways these losses in production may be overcome. The all-important question you have to consider is the economics of doing so.

This series of articles outlines the benefits you can gain from feeding a supplement to your sheep. You will have to draw up your own balance sheet to decide if it is worth while.

THE SHEEP PASTORAL COUNTRY.

Queensland's sheep country runs in a broad tongue up through the centre of the State. Most woolgrowers know the conditions that prevail on their own properties or in their own districts. But the differences that exist between districts are both interesting and important in the supplementary feeding of sheep. Let us compare the main wool growing areas from the sheep's point of view.

Plate 3.

Sheep on Open Mitchell Grass Downs.

The Mitchell grass downs extend from the Nive River near Augathella to beyond Cloncurry. However, in the far north-west they are broken by some low red hills and many river channels. Most of the country north of the Flinders River is shaded, but much of the grass and herbage it grows does not contain enough copper to satisfy the wants of breeding ewes.

The greater part of the "downs" country south of the railway line between Julia Creek and Richmond is open and almost shadeless. There is more timber around Longreach and south of the railway line between Longreach and Barcaldine. Unfortunately, not many trees that can be cut as sheep feed occur in this area.

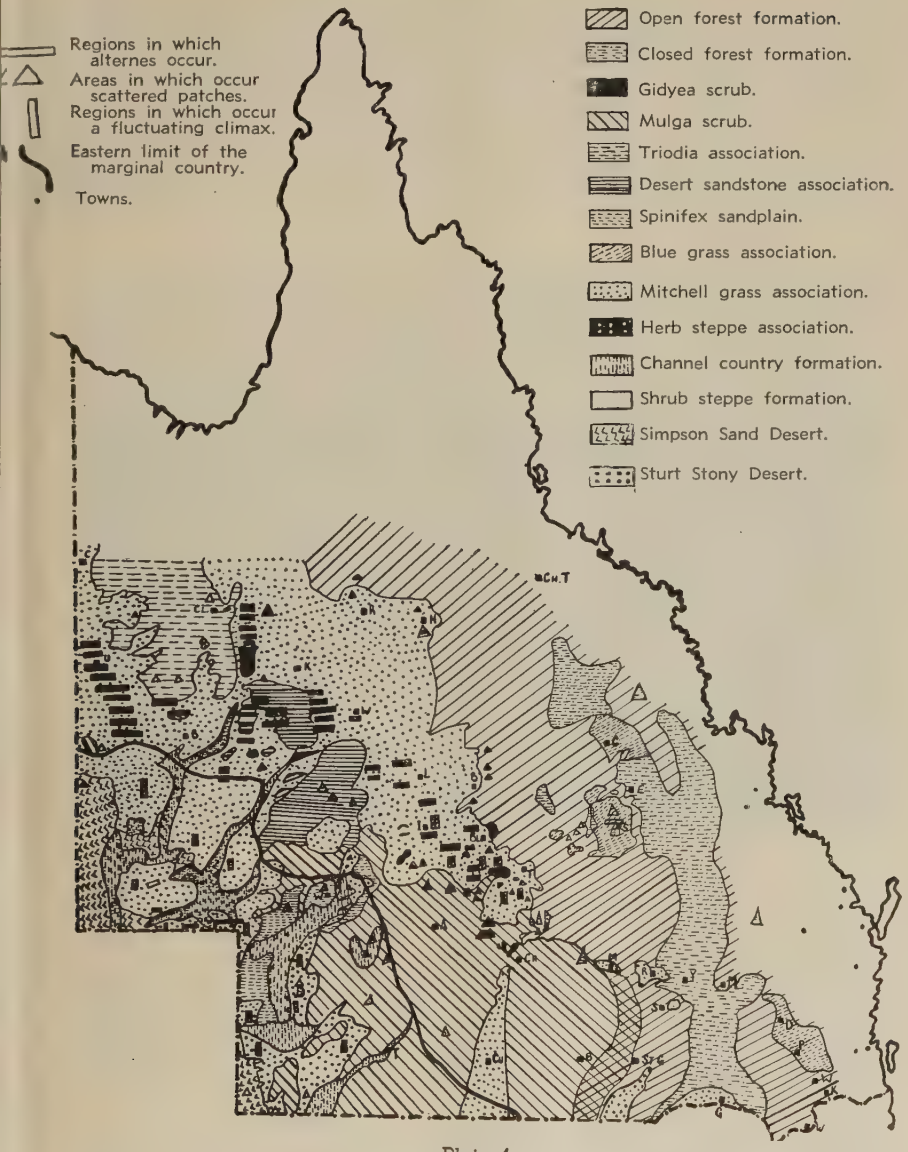


Plate 4.

Western Vegetation Types.

[After a map by S. T. Blake.

The "downs" country south of Blackall is more heavily shaded, but the main stands of edible scrub occur on the mulga country south of Augathella which extends from Thargomindah to Bollon and St. George.

The so-called "desert" country running from north of Tambo through to Alpha and up to Prairie is well known. It carries many trees, and its grasses are usually considered to be coarser than those on the Mitchell grass downs.

The sheep country extending eastwards from Roma towards Miles, and from Goondiwindi to the western slopes of the Great Dividing Range, is amongst the most interesting in Queensland. Besides having a greater variety of softer grasses and herbage plants, this area is likely to develop most as agriculture pushes further west. Similarly, the sheep country of the central highlands is already seeing tremendous advances in the use of agriculture. This is ensuring more and better feed for the sheep in the Springsure, Emerald and Clermont districts.

Plate 5.

Sheep on Dry Winter Pasture, Darling Downs.

Rainfall is all-important in controlling the growth of plants. However, figures showing yearly totals are of comparatively little value. The way the rain falls controls the amount of feed available during the year. So much of pastoral Queensland sees a few months each year when there is too much feed. Unfortunately, there is not enough feed during the rest of the year.

This is particularly true of the open Mitchell grass downs country north-west of Barcaldine. It has received only two months of grass-making rains during the summer of about 75% of the years since people started keeping rainfall records.

Further south, in the Blackall and Tambo districts, winter rains are more frequent. However, the cold winter weather that occurs so often at Tambo may be more severe on the standing grass than the winter weather at Blackall.

Winter rain falls more regularly than summer rain in the Cunnamulla district. However, the summer rain still produces the greatest amount of the feed available to sheep. The herbage plants grow freely after winter rains, and during years when both summer

Plate 2.

Showing the Different Zones Which Enjoy 66 per cent. or Greater Reliability of Effective Rains for Periods of Different Numbers of Months.

Key

Summer—				
Number of wet months	**6**	**4**	**2**	**0**
Symbol	**A**	**B**	**C**	**D**
Winter—				
Number of wet months	**6**	**4**	**2**	**0**
Symbol	**a**	**b**	**c**	**d**

and winter rains fall the sheep are well fed right through the year. Even if the winter rains do not fall the mulga provides a lot of useful fodder.

Further east, in the Roma, St. George and Dirranbandi districts, both the summer and the winter rains are heavier and more regular. Few "dry spells" of more than seven months have occurred in the Goondiwindi district. However, the extremely cold winters in the Mitchell and Roma districts often prevent plants growing in the winter. They also lower the feeding value of any grass standing over from the summer rains.

In the "desert" country between Alpha and Prairie, grass-making rains usually fall during four of the summer months.

Most of the grasses that grow in the sheep pastoral country are well known by their common names. They can be divided conveniently into those like Mitchell grass that persist year in and year out (known as perennials), and the type including Flinders grass, which grow a fresh stand each year from seed and are known as annuals.

THE GROWTH OF PLANTS.

After sufficient rain falls, the roots of the plants absorb chemicals (including minerals) from the soil. These are carried up to the stem by the plant sap. When they reach the leaves they are combined with other chemicals that the plant absorbs from the air. These chemical changes take place most easily and rapidly when the leaves are green and when there is plenty of sunshine. From the chemical changes that take place in green leaves, the plant builds new green shoots that develop into stems and leaves.

Reproduction is the most important part of any plant's life. It sacrifices most of itself to form seed that can grow into new plants.

During the time it is growing the plant makes or stores the various substances required to feed sheep. These include proteins, starch, fats, vitamins, fibre and minerals such as calcium, phosphorus and copper.

During the early growing stages, the plant's succulent leaves contain large amounts of protein. However, as the seeds set, the leaves and stems become more fibrous and most of the protein is stored away in the seeds. Similar changes occur in the distribution and mineral content in the plant. These are influenced by such things as the age of the plant, the type of soil in the place where it grows, and the weather.

The seeds are often the most important part of plants. The principal grains, such as maize, wheat, oats, barley and grain sorghum, are all produced from plants grown especially for the grains they yield. As these plants are grown in farming areas they are unimportant in the sheep pastoral country, except as supplementary feeds.

However, there are quite a number of native plants that grow in the sheep areas that produce large quantities of seed that are relished by sheep. The districts where these plants grow are commonly refered to as "herbage country." They include the areas where winter rainfall is fairly reliable, such as the Goondiwindi district.

TABLE 1.

Showing the Yield Per Acre from Mitchell Grass Downs Country in the Winton District in 1936, and The Percentage of Perennial and Annual Grasses and Herbage Plants in the Plant Material Harvested from an Acre.

Date.	Weight of grass cut per acre.	Percentage of perennial grasses.	Percentage of annual grasses.	Percentage of herbage plants.
	Tons.			
22–10–35	1·3	33·59	2·69	63·74
19–11–35	0·90	49·58	0·84	49·58
Good rain				
6–1–36	..	..	..	..
21–1–36	0·27	92·59	Nil	7·41
18–2–36	1·89	71·16	5·0	23·8
19–3–36	10·20	48·30	27·28	24·34
8–4–36	17·99	67·20	23·36	9·44
23–9–36	14·51	79·95	18·40	1·65

TABLE 2.

Showing the Differences that Occur through the Year in the Composition of Mitchell Grass.

Date.	Grass-making Rains.	Moisture.	Composition on a Water-free Basis.				
			Protein.	Carbo-hydrates.	Fibre.	Lime (as CaO).	Phos-phorus (as P_2O_5).
		%	%	%	%	%	%
January, 1950	..	..	..	..	..	..	..
1–2–50	..	7·3	6·1	47·4	32·7	0·57	0·32
20–3–50	..	6·9	4·4	50·1	32·5	0·48	0·15
4–4–50	X	8·4	4·6	46·4	30·5	0·53	0·25
25–4–50	X	9·4	5·6	40·9	28·3	0·51	0·44
10–6–50	X	7·8	3·5	45·6	36·6	0·52	0·25
July, 1950	X	9·3	3·1	41·9	39·8	0·42	0·19
August, 1950	X	7·6	3·1	51·6	29·4	0·43	0·35
September, 1950	X	8·2	3·0	52·5	27·1	0·43	0·29

TABLE 3.

Showing the Differences that Occur through the Year in the Composition of Flinders Grass.

Date.	Grass-making Rains.	Moisture.	Composition on a Water-free Basis.				
			Protein.	Carbo-hydrates.	Fibre.	Lime (as CaO).	Phos-phorus (as P_2O_5).
		%	%	%	%	%	%
January	..	..	..	..	..	..	..
1–2–50	..	8·1	5·8	46·4	34·8	0·51	0·23
20–3–50	..	6·5	4·0	50·5	32·5	0·33	0·18
4–4–50	X	7·0	4·9	45·4	32·8	0·43	0·29
25–4–50	X	9·4	5·6	40·9	38·3	0·51	0·44
10–6–50	X	7·7	2·5	43·0	41·7	0·48	0·24
July, 1950	X	9·0	3·1	45·5	35·9	0·39	0·21
August, 1950	X	7·9	1·9	50·9	34·4	0·30	0·07
September, 1950	X	8·1	1·6	49·6	38·0	0·24	0·08

Plants like burr clover provide quite a thick coating of seeds or seed pods on the ground and the sheep eat them during the dry months of the early summer.

Some idea of the variations that occur in the chemicals contained in plants during their growing period can be obtained from Tables 1-3. They show the yields per acre and the percentage of perennial and annual grasses, and of herbage in the pasture. They also show chemical analyses of Mitchell and Flinders grasses month by month during the greater part of 1950.

It is clear from the figures given that there is ample good-quality fodder for three or four months after the summer rains fall. However, the quantity and quality of the pasture fall quickly during the late winter and early summer. Of course, from the sheep's point of view, the position may not be quite as bad as these figures suggest. Sheep are selective grazers. They can choose the more tender shoots and in some districts they can browse trees or select from windfalls of leaves or seeds.

The effects of these variations in the quantity and quality of pasture available to the sheep will be discussed in the next article in this series.

WEANING LAMBS.

No matter how well bred a sheep may be, a good start early in life is highly desirable if it is to develop to its maximum inherited capacity. Weaning time is, therefore, very important in the life of lambs if they are to grow into high-producing stock.

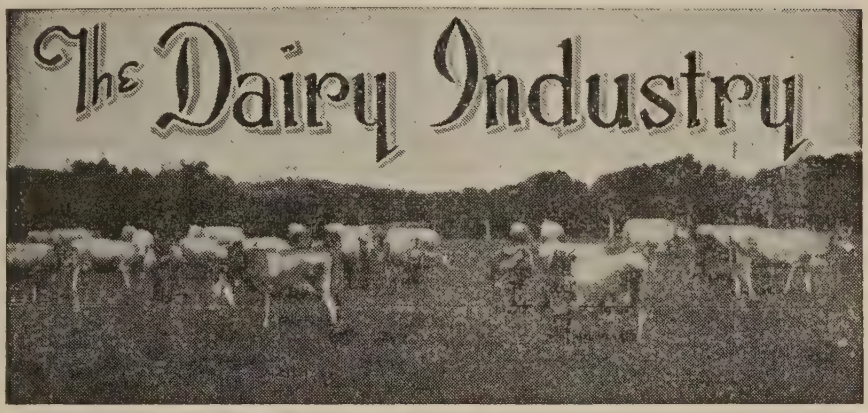
Mr. N. Jackson, Senior Adviser in the Sheep and Wool Branch of the Department of Agriculture and Stock, says you should reserve your best paddocks for the weaners. These paddocks should not only have the best available feed for the young stock, but they should have adequate shade and water facilities and secure fences.

If pastures have been dry for a month or more, or if the weather appears likely to remain dry, it is advisable to drench young sheep with 500,000 international units (3 oz.) of vitamin A emulsion. You are not likely to notice any response in the condition of the stock, but it has been shown that weaners are better able to pull through a dry spell if given a vitamin A drench.

The best age to wean lambs is five months, because by then most ewes have ceased suckling them although they are still conducting the lambs to feed and water. The time taken to crutch and wig the young sheep at weaning is well spent. Wigging is especially useful if the paddock carries burr or if the sheep are likely to become seeded around the head.

Don't forget that weaners have been accustomed to following their mothers to feed and water. If you place them on water in the new paddocks in daylight, they will become used to their new surroundings much sooner than if you just run them through the gate. It is a good idea to put a few dry grown sheep in with the weaners to help show them around their new paddock.

After putting the weaners into their paddock, don't forget them. A few are bound to come back and hang around the fences near the spot where they were separated from their dams. Until the weaners have settled down it is wise to ride the fences carefully every day, driving stragglers out of corners and back to the water points where they can join up with the main flock.



Seasonal Calving for Dairy Cows.

By S. E. PEGG (Chief Adviser, Herd Recording).

Seasonal calving is a subject which has come into prominence amongst the dairymen of this State during the last few years. It has both its protagonists and its antagonists.

The term is given to the practice of calving the whole, or a big percentage of the herd, within a limited period. This period is usually that which is conducive to the greatest production in the ensuing lactation period.

Seasonal calving has been widely practised in New Zealand for many years. In that country a large percentage of the cows calve during a period of six weeks in July and August.

Dairymen in other parts of Australia have chosen that period for seasonal calving which is most suitable for their own particular conditions. The main States to follow this practice are Western Australia, South Australia and Victoria.

An article published in the March 1948 issue of the *Queensland Agricultural Journal* first drew attention to the subject in this State by showing the variations in the production of cows which calved in the various months of the year.

This article was based on production records of 9,587 cows recorded under the Farmers' Own Sample Scheme from 1939 to 1947. These showed that cows which calved in the third quarter of the year produced more than cows which calved in other portions of the year. This trend has been maintained in subsequent years.

The favourable third quarter of the year can be recommended for most areas of the State. There are some localities, however, where the third quarter is not the most suitable period. For example, on the Western Downs the best months are from May to August inclusive. It is considered that farmers should study the trend shown for their particular district.

This question of the most favourable months in which to calve cows has been studied closely since the inception of Group Herd Recording in 1948. It is recognised that seasonal conditions will occasionally upset the best plans and there may be times when the results of seasonal calving are not as good as expected. Very few people, however, are endowed with the ability to forecast the vagaries of the seasons a year or two ahead. Therefore, it is necessary to lay down a

TABLE 1.

EFFECT OF MONTH OF CALVING ON PRODUCTION.

District.	January.		February.		March.		April.		May.		June.	
	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)
All Queensland	2,921	126	2,863	125	2,965	127	3,169	135	3,349	143	3,484	149
	(7·7)		(5·9)		(5·7)		(5·3)		(5·8)		(7·2)	
Atherton Tableland	3,939	168	3,758	166	3,578	151	3,839	161	3,839	160	4,034	170
	(7·6)		(6·9)		(7·0)		(6·9)		(7·0)		(7·6)	
Mackay	2,266	108	2,194	105	2,079	98	2,182	101	2,077	94	2,198	101
	(7·0)		(6·0)		(8·8)		(7·8)		(7·6)		(9·0)	
Central Coast	2,166	95	1,897	86	2,081	92	2,355	104	2,559	109	2,554	112
	(9·2)		(6·1)		(4·3)		(4·8)		(4·1)		(3·9)	
Central and Upper Burnett	2,676	117	2,563	108	2,588	110	2,944	125	3,283	141	3,471	146
	(10·3)		(6·1)		(6·2)		(4·7)		(5·6)		(6·7)	
South Burnett	2,809	117	2,801	116	2,922	121	3,191	132	3,299	136	3,347	137
	(8·8)		(6·6)		(6·3)		(6·0)		(6·2)		(7·4)	
South-Eastern Queensland	2,666	121	2,580	117	2,720	120	2,867	126	3,092	136	3,222	141
	(7·0)		(5·4)		(4·9)		(4·8)		(5·5)		(7·1)	
Eastern Downs	3,544	149	3,510	148	3,524	149	3,760	161	3,965	167	**4,200**	**177**
	(7·4)		(6·2)		(6·5)		(5·5)		(6·1)		**(7.5)**	
Western Downs	2,904	116	2,854	116	3,052	125	3,280	133	**3,538**	**145**	**3,649**	**150**
	(7·9)		(5·7)		(6·0)		(5·6)		**(5.8)**		**(7.5)**	

District.	July.		August.		September.		October.		November.		December.		Total Number of Lactations.
	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	Milk (lb.)	Fat (lb.)	
All Queensland	**3,594**	**154**	**3,592**	**155**	**3,464**	**151**	3,327	145	3,143	136	2,955	128	158,272
	(9.0)		**(10.6)**		**(11.0)**		(12·0)		(10·8)		(9·2)		
Atherton Tableland	4,080	171	**4,303**	**181**	**4,180**	**178**	4,048	174	3,917	168	3,924	168	13,091
	(8·4)		**(8.9)**		**(9.2)**		(11·2)		(10·3)		(8·9)		
Mackay	2,311	107	**2,460**	**113**	**2,443**	**113**	**2,540**	**118**	**2,411**	**115**	2,348	112	2,043
	(8·3)		**(10.1)**		**(8.9)**		**(9.7)**		**(9.8)**		(6·9)		
Central Coast	**3,058**	**136**	**2,947**	**133**	**2,952**	**131**	2,738	123	2,256	111	2,243	99	5,269
	(5.0)		**(6.7)**		**(10.3)**		(15·7)		(16·0)		(13·9)		
Central and Upper Burnett ..	**3,852**	**159**	**3,817**	**161**	**3,620**	**153**	3,474	147	3,266	137	2,981	125	9,670
	(8.4)		**(9.5)**		**(10.4)**		(12·6)		(13·9)		(11·8)		
South Burnett	**3,579**	**146**	**3,363**	**139**	**3,326**	**138**	3,289	136	3,085	127	2,948	123	20,559
	(8.6)		**(9.7)**		**(10.1)**		(10·7)		(10·0)		(9·5)		
South-Eastern Queensland ..	**3,323**	**148**	**3,391**	**153**	**3,237**	**148**	3,116	142	2,919	133	2,735	124	71,257
	(9.5)		**(11.5)**		**(11.7)**		(12·5)		(10·9)		(9·2)		
Eastern Downs	**4,209**	**177**	**4,162**	**174**	4,051	168	3,814	159	3,708	155	3,459	145	23,610
	(9.6)		**(11.0)**		(11·3)		(11·4)		(9·7)		(7·9)		
Western Downs	**3,672**	**148**	**3,624**	**145**	3,500	142	3,365	135	3,182	128	2,942	119	12,327
	(9.3)		**(10.9)**		(10·8)		(11·8)		(9·9)		(8·6)		

The figures in brackets represent the percentage of cows in each case.

The calving months giving greatest production are in heavy type and marked by heavy vertical lines.

farm programme and adhere to it. Droughts and dry spells of lesser magnitude crop up repeatedly to harass the dairyman, and it is his responsibility to counter such vicissitudes by the provision of adequate reserves of fodder to sustain his herd over the lean periods.

The results presented in this article cover all cows which completed lactations under the Group Herd Recording Scheme in the years 1948 to 1954 inclusive. By conducting the investigation over this period of seven years, an overall picture is obtained which is true for all except abnormal years. The seasons covered ranged from good to very bad, which is the normal range of seasons experienced in Queensland.

Table 1 shows the average production for cows calving in the various months for the whole of the State, as well as in the various districts.

Plate 1 shows a histogram of the average production of cows from the whole of the State which calved in the various months of the year.

As it is not always possible to have all cows calving in *one* month of the year, it is urged that consideration should be given to calving them according to the quarters of the year.

When the results are compiled according to quarters, those for the whole of the State for the period 1948-54 are as shown in Table 2.

Plate 1.

Diagram Showing Average Production of Cows According to Month of Calving.
Note the peak in July-Aug.

TABLE 2.

PRODUCTION ACCORDING TO SEASON OF CALVING.

Calving Period.	Percentage of Cows.	Average Production.	
		Milk (lb.).	Butterfat (lb.).
1st Quarter (Jan.–Mar.)	19·2	2,916	126
2nd Quarter (Apr.–June)	18·3	3,349	143
3rd Quarter (July–Sept.)	30·6	3,547	154
4th Quarter (Oct.–Dec.)	31·9	3,157	137

These results are depicted in Plate 2.

Taking the average production of the cows which calved in the first quarter as a basis, the monetary values (at 4s. 9d. per lb. butterfat) of the increased production per cow from cows which calved in the second, third and fourth quarters would be as shown in Table 3.

TABLE 3.

MONETARY VALUE OF SEASONAL CALVING.

Calving Time.	Increase in Production of Butterfat (lb.).	Increase in Monetary Value.
		£ s. d.
2nd Quarter ..	17	4 0 9
3rd Quarter ..	28	6 13 0
4th Quarter ..	11	2 12 3

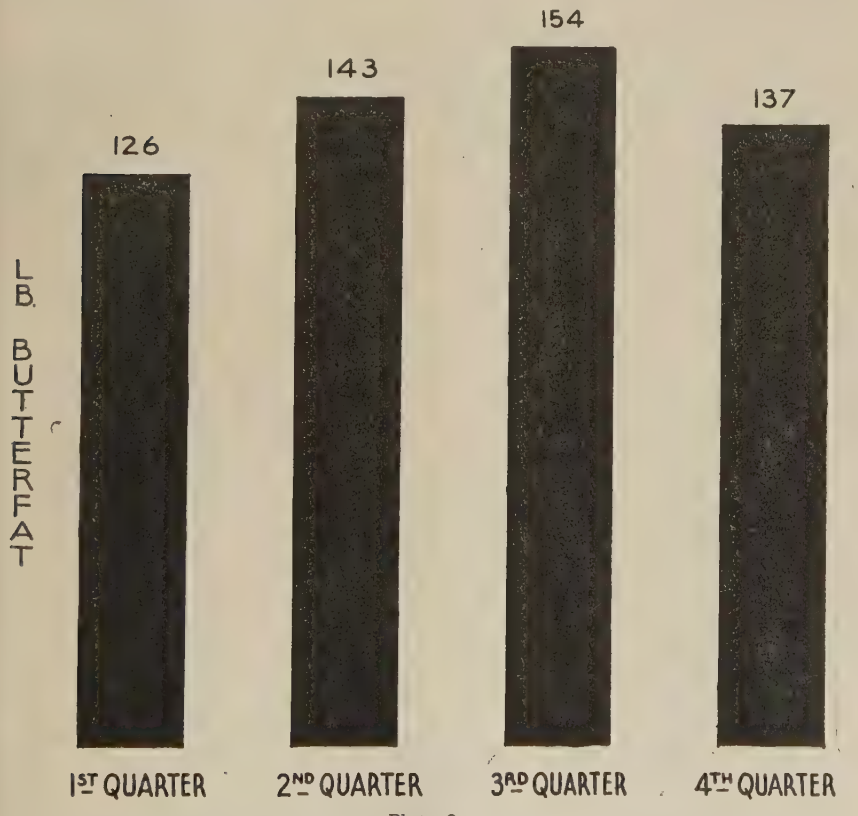


Plate 2.

Diagram Showing Average Butterfat Production of Cows Throughout Queensland Which Calved in Various Quarters of the Year. Note the superiority of the third quarter (July-Sept.).

From the results of the investigation, it is apparent that the cows calving in the third quarter are able to make greater use of the natural conditions prevailing on the farm. If only the 19% of cows which calve in the first quarter were diverted to calve in the third quarter, it would mean an approximate addition to the dairying income of the State of £1,175,000.

It would appear that the stimulus of calving plus a certain amount of winter food enables the cow which calves in the third quarter to produce reasonably well until the storm rains promote a good growth of grass. After milking for five to six months, the wet season arrives with the usual lush growth of pasture and this enables the cow to increase production and continue her lactation for a longer period.

If all cows were fed adequately throughout the year, production would not vary markedly whatever the month of calving, but under conditions which exist on farms in this State, those calving in the third quarter can produce more economically because they make greater use of existing pastures. This is illustrated by the graph in Plate 3. In this are the average lactation curves in weight of milk for cows calving in July 1953 and for those calving in January 1954. These animals were a random sample taken from one herd. The graphs illustrate the ability of the cows which calved in July to milk for 10 months, compared with seven months for those which calved in January, and the manner in which their production is affected. The feeding of conserved fodder during the second to fifth month of lactation would have been beneficial. Those cows which calved in July average 408 gallons of milk and those in January 310 gallons.

ADVANTAGES OF SEASONAL CALVING.

The advantages to be gained by seasonal calving, in addition to higher production and cheaper production (because greater use is made of the natural conditions which exist on the

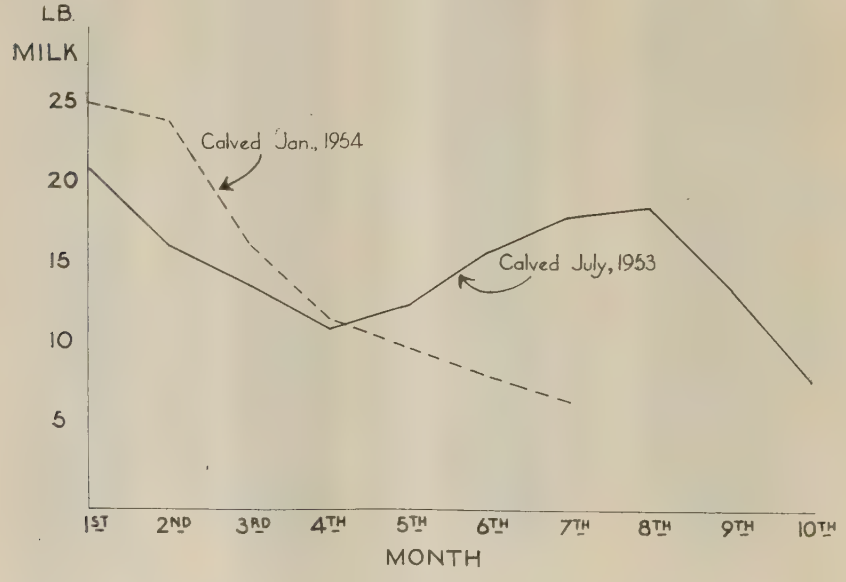


Plate 3.

Cows Which Calve in July Milk Longer. These production curves of cows from the same herd show that those calving in July milked for 10 months, those calving in January for 7 months.

farms), are to be found in more leisure time for the farmer, a short slack period for overhaul of factories, and possibly curtailment of stock losses.

Holiday Time.

A period of two months in which little or no milking would be necessary on the farm. Such a dry period would enable the dairy farmer to take a well-earned holiday. Most dairy farmers find it impossible to leave the farm because the cows have to be milked every day of the year. An annual holiday enjoyed by the whole family would do much to keep the family together, and work would be resumed with a greater zest. Should he not desire such a holiday, the farmer during the dry period could concentrate on maintenance and repair work and other farm activities.

Factory Overhaul.

Factories would also have a period of two months of little or no manufacturing. During this period, it would be possible to give the members of the staff their annual leave, and to carry out a thorough annual overhaul. Factory managers and staff are only too well aware of the difficulties entailed in conducting a major overhaul of the plant while manufacturing is proceeding.

One argument which has been raised against seasonal calving is that it would cause an excessive peak of production which would require factories to seek additional casual labour. An examination of Plate 3 shows that, on the contrary, it would tend to level off production from September to March, and still have a greater output for the year. Under the present system, factories are called upon to handle a very heavy peak during February and March.

Curtailment of Cattle Losses.

A leading grazier recently became interested in the results of this survey, and after examining them expressed the opinion that most graziers could calve their herds earlier with a great deal of advantage. He pointed out that in a drought year the worst effects are usually felt in the October-December period, and heavy losses occur amongst the cows heavy in calf. If the cows calved in August or September in bad drought years, the calves would probably be lost, but the cows would be saved. This could also apply to dairy cattle, although it is realised that the dairyman usually makes greater provision for drought than the grazier. But even so, he is often caught by the vagaries of the season.

WHOLEMILK SUPPLIERS.

Suppliers to the liquid milk trade, until the use of reconstituted milk has been approved, must maintain an even supply of milk throughout the year. Thus the calving of the majority of the cows in the third quarter is impracticable. Nevertheless, such suppliers can profit by the information obtained from the survey, by eliminating all calvings in the first quarter of the year. This is the period of a flush growth of grass, and cows which calve in the third and fourth quarters will provide a sufficient quantity of milk to meet all requirements.

PIG RAISING.

Many farmers have argued that seasonal calving would curtail pig production. It has been shown by officers of the Pig Branch of the Department of Agriculture and Stock that it is possible to maintain production under these circumstances by regulating farrowings and by using a limited amount of protein meal during the dry period. The cost of the protein meal would be a comparatively small additional outlay compared with the increased return to be obtained from seasonal calving.

CHANGING OVER.

The introduction of seasonal calving into a herd where calvings have been occurring throughout the year will

take a good deal of time and forethought. It would be uneconomical to have cows dry for five or six months longer than usual, so calvings would have to be regulated gradually to bring them closer to the best period. This will need complete control of the bull, necessitating a secure bull paddock. Far too many farmers allow the bull to run with the herd and matings take place indiscriminately. The change from this practice will entail some extra work.

The ideal bull paddock should be of sufficient area to allow ample grazing and so obviate the necessity for hand feeding throughout the year. The paddock should be enclosed with an adequate fence of at least eight strands of barbed wire. A suitable shed should be provided as well as shade trees and adequate watering facilities. A strongly built service yard should be erected in the paddock. This should be built of strong wood to a height of at least six feet, and should be approximately 30 ft. x 30 ft. The provision of a crush in this yard is advantageous.

Once seasonal calving has been established, sterility can be a major cause in upsetting the programme and a careful watch must be kept on all cows. This is possible only when the bull is paddocked, his services controlled, and records of service dates are kept.

During the past three years, more and more farmers have adopted seasonal calving and it is considered that within the next decade it will be an established practice in a large number of Queensland herds.

RENOVATING AND TOP-DRESSING PASTURES.

A gradual falling off in the productivity of many Queensland pastures is due to a decline in soil fertility. Large areas of improved pasture have been grazed for as long as 40 years, but little has been done to return to the soil the plant foods taken off as milk, cream or beef.

Officers of the Agriculture Branch of the Department of Agriculture and Stock report that it is now a common practice in some districts to renovate and fertilize pastures to improve yields. These operations should be carried out at a time when there is suitable soil moisture and warm weather to promote rapid regrowth.

Renovators will not work satisfactorily when there is a big body of grass. The pasture should first be brought into a suitable condition by mowing or close grazing.

The simplest method of renovating paspalum is to cultivate the pasture with tined implements. Narrow tines, spaced about five inches apart, are drawn through the sod and the soil. The operation should be performed first in one direction and then at right angles to it, and should be sufficiently deep to break up the soil.

A power-driven rotary hoe is another useful type of renovator for use in paspalum and kikuyu pastures. Under satisfactory soil moisture conditions it will chop up the pasture, but it should be used only during wet or showery weather to ensure regrowth without drying out. Renovation by ploughing is also useful in paspalum pastures, and an implement such as the bush and bog or cutaway disc harrow is suitable for Rhodes grass.

Where a good growth of pasture legume has failed to develop, it has been found profitable, in some areas, to apply a nitrogenous fertilizer. Soil deficiencies of calcium and phosphorus are often found associated with poor legume development. Therefore, when topdressing, a mixture of lime and superphosphate is commonly used.

Farmers and graziers interested in topdressing their pastures may obtain information on the most economical rates of application of fertilizer from their local Adviser in Agriculture.

ANIMAL HEALTH

Cowpox.

By W. R. RAMSAY, Assistant Veterinary Officer.

Everyone is familiar with the story of Edward Jenner's wonderful discovery of the immunising effect of cowpox against smallpox, the turning point of man's struggle against smallpox, one of the most dreaded diseases of old times.

In Jenner's time cowpox was apparently much more common than it is to-day, the explanation offered being that when smallpox was prevalent it was frequently transmitted to cattle by milkers suffering from the disease.

There are indications, too, that horse pox was transmitted to cattle in the same way, for though these are distinct diseases, the viruses which cause them are closely related. For instance, it has happened that a farmer undergoing a vaccine reaction against smallpox has infected the cows in the herd, which in turn have infected the other unvaccinated milkers, who developed pox lesions on their arms, hands and other parts of their bodies. Hence it is evident that recently vaccinated persons should not be allowed to milk cattle.

This method of spread would be very rare under Australian conditions, but is of importance in countries where smallpox vaccination is common. Cowpox still exists and is seen fairly frequently in the dairy herds of Australia. It is a mild disease, the animals rarely showing evidence of a general reaction.

It begins with the appearance of small, hard, inflamed, tender swellings or papules on the udder and teats. Fluid exudes under the skin over these swellings forming vesicles, and later still pus forms in them. Frequently there is a small pit in the centre of these pustules, of which there may be only one on a teat or many.

After about 10 days, if they are not disturbed, the lesions dry and scabs form. These fall off, leaving a smooth surface. The cow is then immune for a considerable time, usually for life.

Unfortunately, the disease occurs most often when heifers are being broken in to milking. The soreness of the udder and teats upsets the animal and tries the patience of the milker. During milking the vesicles may be broken, leaving bare, raw, inflamed ulcers which heal slowly. Bacterial infection of the ulcers can occur and may extend up the teat canal, resulting in mastitis.

Occasionally the disease is introduced into a herd where the milkers have not previously been infected and consequently have no immunity. It runs through the milkers, with subsequent upsets at milking time and loss of production. Animals infected with the disease should not be purchased as replacements, but if inadvertently introduced should be isolated and the affected cows treated as suggested later.

The virus of cowpox can affect man. Pox-like lesions on the hands of milkers led Jenner to this conclusion. The form most commonly seen in man is that of "milker's nodules," which appear about a week

after contact with an infected cow, generally in cracks on the hands. They begin as red swellings which gradually enlarge to a bluish-red nodule surrounded by inflammation. They are quite painless and usually heal in a month or six weeks.

What To Do If You Have a Cowpox Problem.

(1) Milk the affected cows last and by hand until the scabs drop off, being as gentle as possible to avoid bursting the vesicles too early. Soft ointments may help at this stage.

(2) If the vesicles break, treat the resultant sore as an infected wound. Keep it as clean as possible with very dilute disinfectants and dust with sulphonilamide or penicillin powder. Milk the affected cows last, being careful to wash your hands thoroughly with soap and water afterwards.

(3) If mastitis occurs, use treatments recommended by the Department as early as possible.

(4) Do not allow milk from active cases to be used for human consumption.

(5) If the problem becomes serious, consult your local stock inspector or veterinary officer, who will be pleased to help you.

STRIP GRAZING HELPS TO CONTROL BLOAT.

Dairy production can be increased by grazing cows on lucerne or pasture containing a high proportion of clovers. This is most valuable during winter and spring when natural pastures in Queensland are low in nutritive value.

The practice of uncontrolled grazing on young, succulent lucerne and clovers, apart from being wasteful, is, however, often accompanied by the risk of bloat.

Cattle are especially prone to bloat if turned onto leguminous pasture when it is damp from rain or dew or when they are very hungry.

The Cattle Husbandry Branch of the Department of Agriculture and Stock reports that the risk of bloat can be reduced to a minimum by strip grazing legumes with an electric fence. When they are left to graze freely over a paddock, cattle will generally wander haphazardly over the area, nipping off the top few inches of the plant. This succulent part of the plant contains very little fibre.

It has been the unhappy experience of many farmers to have animals bloated under these conditions within 20 minutes or so.

By using an electric fence and allowing the stock a restricted area, the animals are forced to eat the plants down short. As a result, the cattle obtain more fibre than they do when they are allowed unrestricted grazing. Fibre plays an essential role in maintaining correct rumen function and the risk of bloat is thereby largely prevented.

Grazing the cows on natural pasture before they are turned into the lucerne or clover will also provide much-needed fibre.

As an alternative, a useful method of preventing bloat is to place a rack in the middle of the leguminous pasture being grazed and feed grass or cereal hay. Cattle provided with a mixed grass and legume pasture are much less likely to bloat than those on legumes alone.

Infectious Laryngo-Tracheitis of Poultry.

By P. RANBY, Assistant Veterinary Officer.

Infectious laryngo-tracheitis (I.L.T.) is a serious disease of poultry. Together with other respiratory diseases, it forms a complex referred to as the "roup" complex. The symptoms of the respiratory diseases are similar because the respiratory tract is affected. Any one or combination of the following are seen in the "roup" complex—coughing, sneezing, gaping, throat rattles, nasal discharge, watery or bunged-up eyes and distended air sinuses.

The recent discovery of I.L.T. in Queensland (in 1953) has stimulated interest here. Respiratory disease in this State rates high as a cause of economic loss.

In the poultry industry, disease, nutrition and management are closely inter-related, more so than any other industry embracing domestic animals. This applies well to the respiratory diseases, of which I.L.T. rates as the most important member.

CAUSE OF I.L.T.

The cause of infectious laryngo-tracheitis is a virus. Viruses are too small to be seen with the ordinary

Plate 1.

Affected Birds in an Outbreak of Infectious Laryngo-tracheitis (I.L.T.) in Queensland. Note the characteristic gaping of the Australorp.

microscope and will pass through special filters which will hold back bacteria.

As far as we know, the virus of I.L.T. causes disease in the domestic fowl, the pheasant and fowl-pheasant hybrids only. Tests on many other species of birds have failed to set up the disease.

MEANS OF SPREAD.

The main means of spread is by direct contact between infected and non-infected birds. The virus may be picked up by inhaling droplets following the cough of an infected bird or by drinking contaminated water.

Mechanical transmission by fowl crates and sparrows is of some importance. In an outbreak reported in battery chickens in New South Wales, hundreds of sparrows frequented the battery brooder.

"Carrier" birds act as a reservoir of virus following an outbreak of I.L.T. After a period of six months, only a small percentage of recovered fowls remain carriers of the virus, but these will be sufficient to carry the disease on to the next season's birds.

The conception of the carrier fowl explains the tendency for epidemics to follow the transference of new season pullets into permanent laying pens.

Field observations suggest that carrier birds do not occur following successful vaccination.

SURVIVAL OF THE VIRUS.

The survival of the virus is important because it determines the period for which pens which have housed affected birds should be spelled before being used again for susceptible birds.

Evidence suggests that the virus of I.L.T. is not likely to persist outside the fowl for more than a few days. In the sun, it will die in one hour. If properly cleaned and disinfected, pens may be used with safety two weeks after the removal of affected birds.

FLOCK EPIDEMICS.

The spread of infectious laryngo-tracheitis through an affected flock is rapid, all susceptible birds becoming infected within a week or two.

In outbreaks of I.L.T., a great variety of symptoms is seen. In a typical outbreak, the symptoms are most severe early. Birds affected in the next week or two show milder symptoms.

Coughing, gaping and throat rattles are prominent, especially at night. Some also show watery eyes and nasal discharge. Most affected birds recover in two weeks if death does not ensue, but odd cases become chronic (see Plate 2).

In New South Wales, most outbreaks are of the acute type and many early cases show tracheitis (inflammation of the trachea) with blood-stained mucus at post-mortem. Sometimes coughing of free blood is seen as the fowls gape and gasp for air.

In Queensland, outbreaks have been of the mild type and coughing of free blood has so far not been seen.

As a rule, the more severe the outbreak the shorter the course, and the milder the outbreak the longer the course.

In most epidemics seen in New South Wales, the mortality is around 15%. Deaths continue for about a week, after which they practically cease.

Mild outbreaks have a course of two to three weeks and mortality is lower.

Fowl pox vaccination can make infectious laryngo-tracheitis and "colds" flare up if they are present.

ECONOMIC LOSS.

In New South Wales, it is believed that economic loss is mainly due to actual mortality. In some severe outbreaks it has been noted that an affected yard of birds will continue reasonably high egg production during the course of the disease.

In mild outbreaks, the main loss seems to be in egg production. This is the usual experience in Queensland. However, in some outbreaks heavy mortality has occurred associated with predisposing factors such as fowl pox, "wormy" chickens or vitamin A deficiency.

In New South Wales, most outbreaks are diagnosed in the field by the finding of inflammation of the trachea with presence of blood-stained mucus. This is fairly characteristic of the acute forms of I.L.T.

In Queensland outbreaks, a common sign is a cheesy plug (or cast) in the

Plate 2.

A Case of "Bung-eye" Due to Chronic Infectious Laryngo-tracheitis. This condition is seen also in other respiratory diseases.

DIAGNOSIS.

Symptoms.

Any flock epidemic in which a respiratory disease spreads rapidly and coughing and gaping are prominent should be investigated in order to find the cause.

Examination of the Respiratory Tract.

The bird should be first killed by dislocating the vertebral column of the neck so that the trachea is not damaged.

larynx and upper trachea. The dead tissue forming the plug may actually block the entrance to the windpipe and cause asphyxia and death. Other cases show extensive mucus with mild inflammation of the trachea (mucoid tracheitis). In such cases one must resort to laboratory tests in order to confirm any suspicion of I.L.T.

In only three outbreaks here has blood-stained mucus been found in the trachea at post-mortem and virus subsequently isolated from live birds submitted to the laboratory.

Laboratory Tests.

There are two main tests.

(*a*) Isolation of the virus by inoculated tracheal exudate from an affected bird into developing eggs.

Plate 3.

Diagnosing I.L.T. The cheesy plug shown at **a** in the larynx of the trachea at left is a common sign of I.L.T. as seen in southern Queensland. The plug of dead tissue may enlarge and cause asphyxia. A normal trachea is shown at the right.

(*b*) Testing birds for immunity to find whether they have had I.L.T. at some stage and recovered.

In order to isolate the virus, early cases are required. Submitting affected birds to the laboratory several weeks after the outbreak has commenced is of much less value as the virus may be missed. Hence poultry farmers are advised to contact the Department of Agriculture and Stock early in a suspected outbreak.

CONTROL BY VACCINATION.

Vaccination is effected by applying the living virus to the membranous lining of the cloaca, the cavity within the vent.

Types of Vaccine.

There are two main types of vaccine—egg membrane (egg embryo) virus, and tracheal exudate virus.

Egg embryo vaccines are produced in the laboratory by inoculating the virus onto the membranes enveloping the chick embryo in the developing egg. This vaccine has been widely used in Victoria, South Australia, and Western Australia, being made up in the dried form. In Queensland,

a "wet" egg embryo vaccine is prepared at the Animal Research Institute, Yeerongpilly, using the local strain of virus.

Tracheal vaccines are the type used in New South Wales. They are prepared by artificially inoculating cockerels kept for the purpose or from actual field cases. Briefly, the trachea is opened and scraped out. The exudate is ground up with sterile sand and then suspended in buffered glycerol saline.

As the disease has only recently been detected in Queensland, and the use of a living virus is involved, vaccination is carried out by the Department only in those flocks which have been proved infected.

Because the Queensland virus strain produces a milder infection than that generally experienced elsewhere in Australia, the introduction of fowls, other than day-old chicks, or live vaccine from other States is prohibited.

Age to Vaccinate.

Vaccination is generally done on a preventive basis. In Queensland, chickens 6-10 weeks of age are preferred provided they are in good condition.

In an outbreak it is recommended that birds down to three weeks of age be vaccinated. Immunity in chickens vaccinated very young wears off after a time. Vaccination of affected pens is of little or no value. Unaffected pens should be vaccinated.

Catching Screens.

For vaccination to be done smoothly and quickly, catching screens are necessary. The frames are made of light wood such as pine and are 3½ ft. high x 3 ft. wide. Chain wire (½ in.) is used in the frames.

The vaccinator needs two or three assistants. The chickens are herded into the catching screens in groups of no more than about 40 chickens. Smothering may occur if larger numbers are grouped. The chickens are caught and held by the left leg in groups of four or five chickens, depending on their size. As each chick is vaccinated, it is released.

To make the full use of catching screens, the door of the shed should be at the side of the pen and not in the middle. One frame is placed across the doorway and the chickens handed over.

Handling the Vaccine.

The vaccinator should keep the stock vaccine cold to prevent deterioration of the virus. A vacuum flask is excellent for this purpose. The stock vaccine bottles are placed in clean sawdust and ice.

The vaccinating bottle should be shallow and large-mouthed; no more than about ½ in. of vaccine is placed in it from the stock bottle. Vaccine from the chilled stock bottles is added in small quantities at a time so that deterioration does not occur. The bottle is held on a slant so that a higher column of liquid is present when the applicator is dipped in the vaccine.

At no time should the vaccine be exposed to the sun.

Any vaccine not used should be destroyed by boiling or disinfection. If the chickens pick up infection by way of the throat at the same time as they are vaccinated, the disease can be produced.

Inoculation.

Various types of applicators are used for vaccinating. In Queensland, special I.L.T. swab sticks made in Melbourne are used. One stick is used for each bird. As the sticks are used, they are thrown in a tin or box.

The swab stick is dipped in the vaccine and placed in the cloaca of the bird. The membrane lining the cloaca is scratched by a rubbing action with the stick so that the virus can enter.

Precautions.

(1) Fowls low in condition should not be vaccinated. If chickens are wormy, they should be de-wormed first

Plate 4.

Team Vaccinating for I.L.T. The swab stick is inserted into the cloaca or vent of the chick and rubbed against the lining to cause an abrasion. This facilitates penetration by the virus. Note the catching screens.

and vaccinated two weeks later. If infections such as fowl pox or "colds" are present, vaccination should be delayed.

(2) Where fowl pox vaccination is practised, I.L.T. vaccination should always be done first. The reason for this is that a general or systemic reaction occurs between two and three weeks following fowl pox vaccination, and should I.L.T. occur during this period heavy mortality is likely.

(3) All chickens should be vaccinated. The vaccinated chick carries virus in the cloaca for about two weeks following vaccination, so during this time it is infectious. Where groups of chickens are done at different times, they should be separated from one another.

"Take" Reading.

A local reaction occurs in the cloaca following vaccination, commencing at the third day and reaching a maximum in the flock on the fourth or fifth day. The membrane lining the cloaca becomes swollen and rough and is often reddened. The reaction is called a "take" and indicates developing immunity. At the fourth or fifth day, about 20 birds may be caught and the "takes" read. About 95% "takes" should be obtained.

Efficiency of Vaccination.

Immunity following vaccination lasts for life. Strain differences in the virus seem to be unimportant as far as immunity is concerned.

In field vaccination, the efficiency is based on percentage of "takes," which is a fairly reliable index.

Control by Husbandry.

One means of control is by disposal of all stock for slaughter and replacement with day-old chickens. This avoids the necessity of annual vaccination, but should be attempted only if no other farms are in the vicinity. This method of control is usually uneconomic.

Theoretically, since carriers do not occur following successful vaccination, the disease should disappear from the farm once all old hens have gone and been replaced by vaccinated stock —say in three years. It should then be possible to cease vaccinating without risk, but there is little available information on this aspect. In some areas the risk of re-infection from outside sources would in any event make continued vaccination desirable. Risk of the introduction of I.L.T. onto the farm by carriers and infected birds in the incubative stage of the disease may be minimized by adopting a policy of "keeping to day-old chickens only." Abattoir crates should not be brought into the pens.

Chickens to be vaccinated should be kept away from adult stock which have recovered from a previous outbreak.

RENEW YOUR JOURNAL SUBSCRIPTION EARLY.

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The Dairy Calf: Its Feeding and Management.

By A. HUTCHINGS and G. I. ALEXANDER, Cattle Husbandry Branch.

Each year there is a wastage of approximately 20% of milking cows from the average dairy herd. These cows must be replaced by heifers raised from within the herd or purchased as springers.

On the majority of farms, it is preferable to rear calves for replacement purposes rather than to purchase them from outside sources. The farmer cannot assess the status of health, and the production potential of the purchased springer must always be largely unknown. He has a much greater opportunity of assessing these features in home-grown heifers.

The aim is to rear only healthy calves capable of developing into high-producing milkers. Where possible, the calves should be from cows with production records above the average for the herd. They should be normal and vigorous at birth and sired by a bull of good conformation and of proven worth as a sire of high-producing females. They should be kept in clean, sanitary pens and paddocks. Finally, they must be raised on well-balanced rations containing adequate food for normal growth and development.

NUTRITION OF THE CALF.

The young dairy animal requires the following ingredients in its ration for its growth:—proteins, carbohydrates, fats, minerals, vitamins and water. Collectively, the digestible part of these constituents in feeds (including digestible fat multiplied by 2.25) is termed "total digestible nutrients." Water contains no food nutrients, but it also is vital to life and growth.

Total Digestible Nutrients.

In feeding young dairy cattle, it is necessary to provide sufficient total digestible nutrients or total energy for maintenance and normal growth. Energy is used up in the processes of digestion and metabolism, in maintaining the temperature of the body at blood heat, and in breathing and exercising. Energy is also stored as liveweight gains made by the growing animal in the form of protein and fat.

Protein.

Supplying adequate protein according to the growing animal's needs is as important as supplying sufficient energy. The proteins are complex nitrogenous compounds made up of simpler substances known as amino acids.

Most of the gain in liveweight made by growing dairy animals consists of lean or muscular tissue high in protein content. As the animal becomes older, the maintenance requirement assumes greater importance and so the animal requires more energy-rich foods than protein-rich foods.

Minerals.

Young growing cattle require a great number of minerals but the majority of these are in ample supply in the normal diet.

Salt.—Salt is a mineral in which most diets are deficient, or if they are not deficient, would be more efficiently utilised by the addition of salt. Salt to the extent of 1% in the grain supplement is always useful if the cattle do not have free access to salt.

Calcium and Phosphorus.—Calcium and phosphorus are necessary for bone development and so constitute an essential part of the ration for the growing animal. Calves usually receive sufficient calcium from milk and pasture to satisfy their requirements, but sometimes phosphorus may be deficient, especially after weaning. Where grain supplements are supplied there is little risk of phosphate deficiency.

Copper.—Many instances of copper deficiency in young stock have been found during the past few years. The effects of copper deficiency are loss of appetite, stark coat (sometimes with loss of colour) and retarded growth. There is often a seasonal scour, with rapid loss of condition. Copper deficiency may be corrected by adding small amounts of copper sulphate to the drinking water. Alternatively, the calves may be drenched with a worm drench containing bluestone. This has the twofold effect of reducing the worm population and treating the copper deficiency.

Vitamins.

Of the several vitamins necessary for health, vitamin A is the only one likely to be deficient. At birth, calves have very little reserve of vitamin A in their bodies; it is provided for them in the colostrum and milk. Colostrum contains up to 70 times as much vitamin A as normal milk. This is one of the important advantages of colostrum. For three or four days after calving, colostrum is rich in this vitamin; it falls rapidy to the level of milk during the following few days. As vitamin A is contained in butterfat, skim-milk contains very little, and for this reason alone it should not be fed to calves under two weeks of age.

Vitamin A is important in growth and health of calves; it is essentially a "protective" against disease. Deficiency causes degeneration in the mucous lining of the digestive and respiratory tracts and may cause eye disorders. Low vitamin A in the cow's feed before calving is reflected in a low content in the body of the calf at birth and in the colostrum.

Lucerne hay, all succulent green feed and yellow maize are rich in vitamin A and one or more of these feeds should therefore be fed to calves as soon as they will pick at them. The body possesses the ability to store vitamin A in the liver to maintain a reserve for times when the diet is deficient.

Vitamin D is necessary for health and formation of bone. Lack of this vitamin may cause rickets. Since it is absorbed from direct sunlight, there is no deficiency in this State. Hay absorbs vitamin D during curing in the paddock and practically all hays will contain small amounts of it.

Fish oil is especially rich in vitamins A and D. It should therefore be given to young stock being fed skim-milk with little or poor hay or pasture.

There is no known deficiency of any other vitamin.

Water.

A plentiful supply of clean water should always be available to calves even when they are getting milk. The amount of water required increases as milk is reduced. As with all animals,

calves will drink several times during hot days. It is therefore desirable to have water close to shade. Inadequate or impure water supply reduces appetite, with consequent loss of condition and slowing of the growth rate.

SYSTEMS OF CALF FEEDING.

There are several methods of rearing calves. The one used will depend on many factors, including size and type of dairy farm, disposal of dairy produce, cost and availability of milk substitutes and calf feeds, and locality. Stud breeders feed liberally, while wholemilk supply farmers often restrict feeding too severely.

(1) Raising Calves on Nurse Cows.

This is a practical and often profitable way to rear calves. Less labour is needed and they are usually less trouble to feed, thrive better and appear to be less susceptible to disease than those raised by other methods. The culls from the milking herd are usually the foster mothers. They include cows which are difficult to milk because of a quarter lost due to mastitis or of a pendulous udder.

One cow can handle 2-4 calves at a time, depending on the quantity of milk produced, and it may raise several sets of calves during a lactation. Each calf must obtain the colostrum from its dam before being placed on a nurse cow. It should not be allowed to get too much milk at the start, and can be raised well on ¾-1 gallon daily. Its condition indicates the amount of milk it obtains.

When 2-3 weeks of age, they should have access to good hay and some grain mixture. They can be taken from the nurse cow at two months of age provided they are eating meal and hay in sufficient amounts.

(2) Wholemilk Method.

The quality of wholemilk fed will depend on the size and condition of the calf. In attempting to grow a good calf, the tendency is to feed too much at an early age; this starts indigestion and scours. The age at which to wean off wholemilk depends on its availability and the cost the owner is prepared to allow. Generally speaking, 40 gallons of wholemilk is the minimum for rearing really good calves with plenty of bloom. However, calves can be reared on half this quantity. This method is often used for rearing stud stock or stock for sale.

(3) Wholemilk plus Skim-milk.

This is the most widely used method of rearing calves on cream supply farms. Calves so reared on restricted wholemilk but with liberal quantities of skim-milk will make almost as good liveweight gains as by the previous method, but may not hold the bloom. When reared on restricted wholemilk and skim-milk, calves will not grow as fast up to 4 or 5 months, but recent trials have proved that, given adequate good roughage, they practically catch up to the wholemilk reared calves at one year of age.

At the beginning, from ½ to 1 gallon of wholemilk is fed daily, proportionate to the size of the calf, and is given in two feeds.

It is not necessary to increase the quantity of wholemilk, as when the calf is about two weeks old skim-milk can be added to bring the total quantity of the mixture to 15% of the body weight. At a month old, an average Jersey would receive one gallon of fluid daily and an A.I.S. 1¼-1½ gallons. The amounts of wholemilk, skim-milk and meal allowances for calves for the first five weeks of life are as follows:—

Age (weeks).	Wholemilk.	Skim-milk.	Meal.	Lucerne Hay.
1	All	..	..	..
2	All	..	..	..
3	3 parts	1 part	Commence with small amounts; increase to all calf will clean up	..
4	1 part	1 part		Full access
5	1 part	3 parts		
6	..	All		

The change from wholemilk to skim-milk should extend over three weeks, and an even, regular temperature near blood heat must be maintained.

From the sixth week the quantity of skim-milk can be varied according to the amount available. One gallon daily is sufficient, but with strong calves up to 3 gallons daily can be fed. Milk should be fed from buckets. Trough feeding is undesirable, as the greedy animals get more than their share to the detriment of the weaker ones.

When the butterfat is removed, the energy or fattening value of the milk is halved, but the protein content is practically unaltered. This makes it necessary, when changing from wholemilk to skim-milk, to provide supplementary feed. Good coarsely gristed grain mixtures and by-products such as pollard and bran are satisfactory. Protein-rich meals are not necessary. Any grain mixtures can be fed—the proportion of the grains will be governed by their cost and availability.

Sample mixtures are:—

Wheat Oats Sorghum	Equal parts.
Wheat Sorghum Bran	Equal parts.
Wheat Maize Oats Pollard	Equal parts.

Add 1% salt, 1% calphos and 1% pulverised limestone to all mixtures.

It is better to include several grains in a mixture, as the palatability is thereby usually improved, and should any one grain not become available, the palatability of the mixture is altered little.

(4) Limited Wholemilk Feeding.

In the wholemilk supply area surrounding Brisbane, farmers have always been faced with a number of problems—feed supply, preservation of milk, and winter production of milk. Winter production of milk is of major concern, as a quota system exists by which the summer milk sale bears a fixed ratio to the winter milk supplied. The quantity of wholemilk the farmer is allowed to supply during the summer months is determined by his winter production. This means that a farmer with seasonal calving in the summer months would have virtually no summer wholemilk outlet because of his low winter milk production when his cows are in mid or late lactation.

This quota system encourages calving at all seasons and an even supply of milk throughout the year. Consequently, the farmer is often faced with rearing calves during winter. This would not be a major problem if there was a plentiful supply of milk, as climatic conditions are not severe. However, he must rear his calves when milk is at its highest monetary value.

The method of limited wholemilk feeding has been developed to meet this need. By this method the farmer may reduce the calf's consumption of wholemilk to the absolute minimum. In order to do this, the calf must be fed a highly palatable substitute for the wholemilk. This should take the form of a calf meal containing approximately 20% crude protein. The calf should be allowed free access to the calf meal and be encouraged to eat it at the earliest possible age, as it is only when the calf is eating an appreciable amount that the milk allowance may be reduced. Calves may

be reared on as little as 15 gallons of wholemilk. This is the absolute minimum and it is probably best not to go below 20 gallons. The feeding schedule is as follows:—

Age (weeks).	Milk (lb. daily).		Meal (lb. daily).	Lucerne Hay (daily).	Pasture.
	Jersey.	A.I.S.			
Birth–2 days	Colostrum	Colostrum	..	..	..
1	6	7	..	..	..
2	6	7	..	..	..
3	6	4	⅓	All it will eat	All it will eat
4	3	3	⅔	All it will eat	All it will eat
5	1	1	1	All it will eat	All it will eat
6	..	..	1½	All it will eat	All it will eat
7	..	..	2	All it will eat	All it will eat

The composition of the calf meal fed is quite important. Of the 20% protein in the meal, at least 10% (that is, 2% of the whole meal) should be of animal origin.

Many different calf meals, called "calf starters," are available, but for those farmers who do not mind extra trouble a calf starter may be mixed on the farm. This will prove much cheaper if home-grown grains are used. At present market prices, the very palatable meals of animal origin, such as skim-milk and buttermilk powder, are quite expensive, and to reduce cost they may be almost entirely replaced by the equally nutritious, but less palatable, meat meals.

The following are suggested formulas for calf starters:—

(i.) Crushed Wheat .. 4 parts
Crushed Sorghum .. 3 parts
Crushed Oats .. .. 5 parts
Pollard .. .. .. 2 parts
Skim-milk Powder or Buttermilk Powder 2 parts
Meatmeal .. .. .. 4 parts

(ii.) Crushed Wheat .. 2 parts
Crushed Oats .. .. 1 part
Crushed Maize .. 1 part
Linseed Meal .. .. 1 part
Meatmeal .. .. 1 part

(iii.) Maizemeal .. .. 1 part
Sorghum Meal .. .. 1 part
Buttermilk Powder .. 1 part
Linseed Meal .. .. 1 part

To each of these meals add 1% ground limestone, 1% salt and 1% bone flour.

The calf is allowed to get its colostrum from the dam for the first two days. It is then removed and hand-fed its allowance of milk. If desired, the colostrum can be preserved with formalin at the rate of 1-3 tablespoonsful to 10 gallons of milk and used over the ensuing week. At the end of the second week, a little meal is placed in a trough or box in front of the calf. If the calf is to be fed the meal dry, a little should be rubbed on the gums or lips of the calf to encourage it to eat. An alternative is to place a little in the bottom of the bucket just before all the milk has been drunk. If meal is to be fed as gruel it can be placed in the milk from the second week onwards. There are some advantages in dry meal feeding, but if for economy a less palatable but no less nutritious meal is used, gruel feeding usually ensures that the calf eats its full requirements at, or even before, termination of milk feeding.

Figure 1 shows the daily wholemilk allowance, meal eaten and growth rate of calves reared on three dairy farms in the Brisbane district during the past four years.

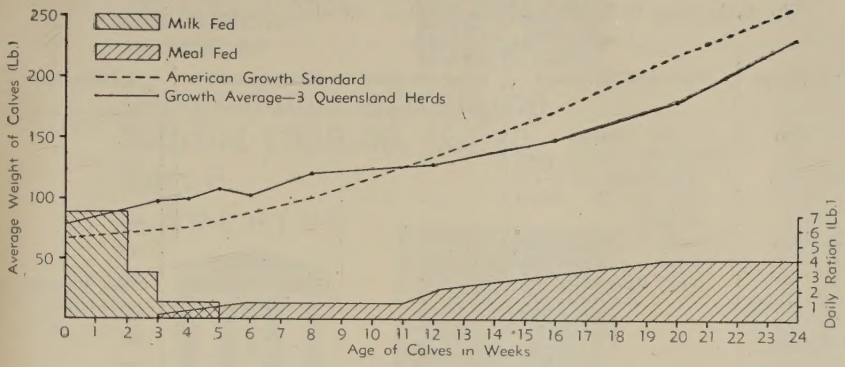
Milk Fed
Meal Fed
American Growth Standard
Growth Average—3 Queensland Herds
Average Weight of Calves (Lb.)
250
200
150
100
50
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Age of Calves in Weeks
Daily Ration (Lb.)
1 2 3 4 5 6 7

Fig. 1.

Graph Showing Ration Fed and Rate of Growth on Limited Wholemilk Feeding.

(5) Limited Skim-milk Feeding.

The majority of calves are reared on skim-milk in Queensland, and many farmers fed skim-milk up to six months of age. As there will be more use of wholemilk as such, and wholemilk products (powders), the trend will, no doubt, be towards limited skim-milk feeding of calves, for the wholemilk from periodic or "blocked" days can be separated. The skim-milk can then be preserved by the addition of 1-3 tablespoonsful of commercial formalin per 10-gallon can of milk, which will be usable over the next two weeks. Thus, the skim-milk saved on days when no delivery is made may be saved for calf rearing.

Rearing calves on limited skim-milk without wholemilk can be done quite successfully with a little extra trouble. Calves must get all the colostrum either direct from the cow and be fed it for at least four days. Skim-milk is introduced gradually, and at the end of the sixth day can replace the colostrum, which should be continued as long as there is some available. It is imperative that fish liver oil or emulsion be added to this milk to provide about 5,000 International Units of vitamin D per day (this can be calculated from directions on the container). Skim-milk should be fed at the rate of 10-12% of body weight and it must be near blood heat.

Meal feeding must be commenced in the second week. It is preferable to feed it with the milk, and when milk ceases at 30-40 days to continue feeding it as gruel. An average calf will eat 1 lb. meal daily at 6 weeks of age, and 2 lb. daily at 8-10 weeks. Hay and pasture should be fed as in all methods of calf rearing. Buttermilk has approximately the same feed value as skim-milk and is used in the same manner.

(6) Feeding Whey.

Skim-milk is often scarce in cheese-making districts, but ample whey may be available. Fresh whey lacks the fat and most of the proteins of wholemilk. Its value is mainly in its sugar content, and its energy value is about two-thirds that of skim-milk or one-third that of wholemilk. In addition, it is rather laxative. It needs to be introduced gradually and fed with good hay and meals at least equal to skim-milk meal feeds. For best results the calf should be given a good start on wholemilk and gradually changed to fresh whey from the fourth week.

The following is a satisfactory feeding schedule based on whey:—

Age of calf.	Wholemilk (lb. daily).	Whey (lb. daily).	Meal (lb. daily).	Lucerne Hay.
2 days	On mother	..	..	Free access at all times
5 days	Mother's milk and colostrum at 1 lb. per 10 lb. body weight.	..	..	
14 days	Mixed wholemilk at 1 lb. per 10 lb. body weight	..	..	
3 weeks	10	..	A little	
4 weeks	7	3	¼	
5 weeks	3	8	¾	
7 weeks	..	13	1	
9 weeks	..	14	1½	
14 weeks	..	14	2	
24 weeks	..	16	3	

(7) Dried Skim-milk and Dried Buttermilk.

These by-products of the butter industry can equally well replace meals or calf starters used in conjunction with limited wholemilk rearing. They can, indeed, replace 5 gallons of wholemilk, thereby allowing calf rearing on 10 gallons of wholemilk plus skim-milk or buttermilk powder. Their cost of £60-£70 per ton limits their use.

(8) Milk Substitutes.

During the last few years a few milk substitutes intended to replace wholemilk entirely have been put on the market. Calves receive only their colostrum for the first few days and thereafter are fed the wholemilk substitute in liquid form.

As already stated calf starters may largely replace all milk at a very early age. The addition of 5% molasses increases the palatability of the mixture and improves conditions for desirable bacteria in the digestive tract. Examples of suitable formulae are given in an earlier section.

(9) Antibiotics.

While the addition of small amounts of an antibiotic has promoted increased growth in chickens and pigs, the response in calf feeding has been slight, and then only with the use of aureomycin. At present the cost of this material precludes its use.

Early Departmental experiments have been carried out with feeding penicillin antibiotic to calves, but results have not indicated any value in the practice.

At the present time, it appears that good hygiene and correct feeding give as good results as antibiotic feeding, and they are cheaper.

(TO BE CONTINUED.)